U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-262 919

Air Pollution Abstracts 1251-1778. Volume 1 Number 7, 1970

Environmental Protection Agency, Research Triangle Park, N C

1970

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. APABCA-1-7-1970	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Air Pollution Abstracts Volume 1, No. 7		5. REPORT DATE 1970 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Air Pollution Technical Information Center Research Triangle Park, North Carolina 27711		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Same		13. TYPE OF REPORT AND PERIOD COVERED 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

Spine bears the title.

16. ABSTRACT

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts 1251 - 1778.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air pollution Abstracts Information retrieval		13B 5B

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES 163
	20. SECURITY CLASS *(This page)*	22. PRICE 6.75

EPA Form 2220-1 (9-73)

PB 262 919

Volume 1, No. 7
Abstracts 1251—1778

NAPCA Abstract Bulletin

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Health Service

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

NAPCA ABSTRACT BULLETIN

Prepared and Distributed by:

Office of Technical Information and Publications (OTIP)
Air Pollution Technical Information Center (APTIC)
National Air Pollution Control Administration (NAPCA)
1033 Wade Avenue
Raleigh, North Carolina 27605

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U. S. Department of Health, Education, and Welfare
Public Health Service
Environmental Health Service

TABLE OF CONTENTS

The categories used to organize the "NAPCA ABSTRACT BULLETIN" have been changed slightly to permit more effective use. Scope notes for each category are given as a guide to our readers.

page

EMISSION SOURCES

Information pertaining to an industry, process, or material associated with air pollution. Documents in this category are concerned primarily with characteristics of a specific class of emission sources including types, rates, industries; secondary coverage may include effects, control methods, etc. 1

CONTROL METHODS

Includes equipment and both specific source control and general abatement efforts. Included are documents describing the operating principles, design, operation, efficiency, etc., of equipment and methods of removing pollutants from the air. The scope of the document can vary from a device for a specific source to an approach applicable to an entire industry--e.g., automobiles. 17

MEASUREMENT METHODS

Includes equipment as well as methods. Confined to development, testing and evaluation of pollutant determination methods (sampling, analytical, monitoring) and equipment, as such. Data obtained by use of methods in specific applications are placed in the applicable subject categories. 41

AIR QUALITY MEASUREMENTS

Pollution measurements in the ambient air, generally related to specific geographical locations, such as area surveys. Also includes general reviews of area situations and emission source inventories. 65

page

ATMOSPHERIC INTERACTION

All chemical and physical phenomena occurring in the atmosphere. Included is material on dispersion, air pollution forecasts, meteorological effects, topographical effects, photochemical reactions in the atmosphere, etc. Laboratory studies of photochemical reactions fall under Basic Sciences and Technologies. 71

BASIC SCIENCE AND TECHNOLOGY

General discussions or data compilations for the basic physical and chemical properties of pollutants. Theoretical and laboratory studies on related chemical and biological reactions and mechanisms. Mass transfer and other basic knowledge related to process engineering applications in emission control or abatement. Excludes atmospheric photochemical studies and biochemical studies related to effects of air pollution. 83

EFFECTS-HUMAN HEALTH

Covers medical and epidemiological studies; biological effects other than those on plants and livestock produced by air pollutants; laboratory animal experiments. 105

EFFECTS-PLANTS AND LIVESTOCK

Effects on vegetation--crops, trees, other plants--and on livestock as distinguished from laboratory experimental animals. 121

EFFECTS-MATERIALS

Deterioration, corrosion, etc., of physical materials, buildings, and structures. 127

ECONOMIC ASPECTS

Economic implications of air pollution and its control, e.g., economic losses from pollution damage, and costs of control programs or equipment in general. 129

STANDARDS AND CRITERIA

Recommended or adopted guides, criteria and standards for allowable emission limits or pollutant concentrations, air quality, equipment characteristics, and fuels. 131

page

LEGAL AND ADMINISTRATIVE

Legal aspects include legislation, ordinances, rules, litigation, hearings, decisions, etc. Administration covers administrative and miscellaneous information concerning control agencies and control and research programs. Typical topics are personnel, budgets, contractual activities and program descriptions. 133

SOCIAL ASPECTS

Sociological and psychological aspects such as social attitudes, public opinion studies, public relations, and public information. 139

GENERAL AND MISCELLANEOUS

Reviews of general problems, trends and background. Documents not assignable to other categories. 141

SUBJECT INDEX.. 143

AUTHOR INDEX... 149

ORDER FORM... 161

EMISSION SOURCES

1251 APTIC NUMBER 12333

Alpiser, Francis M.
JUNK AUTO DISPOSAL AND CLEAN AIR. Preprint, Inst. of Scrap Iron and Steel, Washington, D. C., 26p., 1969. 16 refs. (Presented at the Symposium on air Pollution Convention of the Institute of Scrap Iron and Steel, New York, N. Y., Jan. 11-14, 1969.)

As part of the study on the problem of open burning, an investigation was undertaken of air pollution from the disposal of junk autos. A review of the literature and on site observations of junk auto disposal were conducted. Visible air pollution from the disposal processes was judged by opacity using the Ringelmann chart. Where gas or oil-fired afterburners were used in connection with auto body incinerators, visible stack emissions from incinerators were less than one-half of No. 1 Ringelmann, provided afterburner temperatures and residence times were properly maintained. Emissions from a tunnel incinerator equipped with electrostatic precipitators and a rotary kiln unit with a gas fired afterburner and scrubbers had an opacity equal to or less than Ringelmann No. 1. However, these incinerators were characterized by operating difficulties and/or excessive maintenance costs. Processes using mechanical disintegration were also visited. Large fragmentizers produced emissions less opaque than one-half of No. 1 Ringelmann. Since little or no burning is involved, the fragmentizer offers a partial solution to the disposal problem for large metropolitan areas. Only these areas generate enough cheap and easily available junk autos for a large fragmentizer. However, the economic feasibility of this process depends on the scrap market. Installation costs for large fragmentizers vary from $1.5 to $3.0 million and do not include the cost of auxiliary equipment and land.

1252 2 APTIC NUMBER 11963

Block, H. and A. Duhme
REFUSE INCINERATION ACCORDING TO THE VOLUND SYSTEM. Aufbereitungs-Technik, no. 3:120-125, 1964. 2 refs. Translated from German. 17p.

With the Volund continuous incineration system, the furnace plant is fully mechanized from the refuse feeding point to the slag discharge. The throughput speed of the refuse can be adjusted for individual zones. Drying the refuse with a widely fluctuating moisture content and its ignition is effected on grates designed as stokers with reciprocating grate bars. Drying the refuse in the preheated air or hot waste-gas current, in combination with the reflected heat from the firing chamber, is intensive and permits the processing of very moist garbage without interfering with the smooth operation of the system. From the ignition grate, the garbage reaches the rotating drum, which is slightly inclined toward the longitudinal axis. The drum, which as a fire-resistant lining, rotates at an infinitely variable speed according to the furnace speed. The combustible components remaining in the refuse are burned as much as possible by the continuous churning and by the addition of high-temperature air to the drum wall. Additional heat is supplied by the flue gases. At the end of the drum, slag is removed by a wet-type installation. Volund plants are highly insensitive to fluctuations of heating value and load. To help solve the problem of sewage sludge destruction, a plant can be equipped with a parallel-operating sewage sludge treatment plant. For drying, waste gases from the refuse incineration plant can be used. The mixture of waste gases and vapors is later recycled to the main gas current from the refuse incineration to destroy aromatic substances. The dried sewage sludge can then be burned in the incineration plant.

1253 APTIC NUMBER 17459

Bode, Willi
THE INFLUENCE OF SULFUR IN THE FUEL ON THE COMPOSITION OF THE EXHAUST GASES OF DIESEL ENGINES. (Der Einfluss des Kraftstoffschwefels auf die Zusammensetzunt der Verbrennungsgase eines Dieselmotors). Text in German. Motortech. Z. (Stuttgart), 29(12):500-505, Dec. 1968. 17 refs.

Dew point measurements were taken near the outlet valve at different loads of a Diesel engine of the type 1 NVD 18 (1000 rpm). It was determined how the sulfur dioxide, sulfur trioxide, and sulfuric acid concentration changed with a change in the fuel to air ratio at a constant sulfur content in the fuel. The question was studied whether the gas concentration in the exhaust pipe can be theoretically calculated. Comparison of the gas concentrations calculated with the law of mass action and the experimentally measured concentrations indicated that a theoretical calculation has significance only for the range of high gas temperatures. Apart from the sulfur in the fuel, the formation of SO_3 and of H_2SO_4 is strongly influenced by the fuel to air ratio. The dew points were measured with a special sensor consisting of a ceramic tube which was cooled inside with compressed air. It contained a resistance thermometer made of 0.05 mm platinum wire. The measurements yielded that at idle conditions (lamda equals 5.3) and a cylinder wall temperature of 120 C, as well as at a maximum sulfur content in the fuel of 2.5% by mass, no chemical attack by the condensating sulfuric acid occurs. At lamda equals 2 and a sulfur concentration of more than 2% by mass, however, sulfuric acid is precipitated due to the high dew point temperatures. But it is difficult to predict just how much this would affect the cylinder, since a thin protective oil film is always present.

1254 APTIC NUMBER 12294

Bokov, A. N., G. P. Trubitskaya, P. Z. Li, Z. V. Mikhailova, E. L. Kaganova, Yu. D. Dudina, and S. D. Glushkova
THE BIOLOGICAL EFFECTS OF FIBER GLASS-REINFORCED PLASTICS BASED ON UNSATURATED POLYESTER RESINS, WHICH ARE USED IN BUILDING CONSTRUCTION. (Gigienicheskaya otsenka stroitel'nykh steklo-plastikov na osnove nenasyshchennykh poliefirnykh smol). Hyg. Sanit., 33(7-9):174-180, July-Sept. 1968. 9 refs.

Investigations of volatile and toxic emissions from glass fiber-reinforced construction materials were performed in special generator chambers, where environmental conditions could be simulated and maintained for prolonged periods; the parameters included the air change factor, temperature, and ratio of sample surface to chamber volume (degree of saturation). Air issuing from the chamber was analyzed for styrene, isopropylbenzene hydroperoxide, methacrylates, toluene, and dimethylaniline, among other substances. Some of the plastics tested were rated completely unacceptable, since they released harmful substances in concentrations which exceeded their maximum permissible levels in outdoor air and which constituted a considerable portion of maximum levels in industrial atmospheres; others were judged acceptable as building materials; the remainder fell between the two extremes. The type of filler used in the plastics was found to affect the glass-resin ratio and hence the quantity of liberated toxic products; other conditions being equal, the samples tested were less toxic when glass fabric was used as filler. Only by the simultaneous adjustment of curing agent, filler, and supplementary heating could acceptable samples by produced, as opposed to adjusting any one of these variables.

1255 APTIC NUMBER 18127

Brubacher, M. L. and J. C. Raymond
CALIFORNIA VEHICLE EXHAUST CONTROL. J. Air Pollution Control Assoc., 19(4):224-229, April 1969. 11 refs.

California's experience with vehicle exhaust controls for three model years is related, and future possibilities for improving the continued effectiveness of these controls are discussed. Tests of exhaust controls on 1966 and subsequent model cars in public use indicate a reduction in hydrocarbons of about 60% for the vehicle life of 100,000 miles compared to uncontrolled cars. However, emission levels and emission deterioration rates in public use are higher than those reported from proving ground tests. Significant percentages of new cars are delivered from the factory maladjusted which has a significant effect on emissions. These maladjustments are worsened by automotive service personnel. (Author's Abstract)

1256 APTIC NUMBER 12153

Chevalier, C. E.
HYDROCARBON CONTENT OF THE BLOWBY GASES OF AN AUTOMOTIVE DIESEL ENGINE. Pennsylvania State Univ., University Park, Dept. of Mechanical Engineering, Contract PH 86-62-24, 32p., May 1962. 5 refs.

The hydrocarbon content of the crankcase breather gases of an automotive diesel engine, installed on a dynamometer, was investigated at all conditions that might be expected to occur in actual use. The blowby gases were analyzed for total hydrocarbon content in a hydrogen flame ionization detector. The absolute amount of unburned hydrocarbons emitted from a diesel engine via the crankcase breather was very small. The engine blowby rate was relatively independent of load, and decreased slightly with increasing engine speed. The unburned hydrocarbons emitted from the crankcase breather were predominately composed of lubricating oil mist and vapor, and the concentration was dependent upon engine operating conditions. In particular, the temperature of the cooling water, lubricating oil, cylinder walls, and internal surfaces was the primary determining factor. At normal engine operating temperatures, the engine fuel rate and the engine thermal level were closely related. Therefore, the unburned hydrocarbons level in the crankcase gases is a direct function of the engine fuel rate under all normal engine operating conditions. Operating the engine at an overload or with different fuels does not significantly affect the unburned hydrocarbon concentrations; the use of lubricating oils with different viscosities does affect the concentration. The diesel breather gases are not a serious offender in terms of air pollution because of the very small unburned hydrocarbons emission rate. No crankcase emission standards exist for this type of engine (1962), but in terms of an acceptable limit of 0.15% of the fuel rate for spark ignition engines in California, the diesel engine unburned hydrocarbons emission is below this figure even at the worst condition. (Author summary modified)

1257 APTIC NUMBER 12154

Chevalier, C. E.
HYDROCARBON CONTENT OF THE BLOWBY GASES OF SEVERELY WORN AUTOMOTIVE DIESEL ENGINES. Pennsylvania State Univ., University Park, Dept. of Mechanical Engineering, Contract PHS 86-64-76, Automotive Safety Research Program Sept. 15, 33p., Oct. 1964. 6 refs.

The effect of diesel engine age and service on crankcase hydrocarbon emissions was evaluated in field tests of engines ready for major overhauls. The engines were randomly selected from diesel-powered trucks and were installed in tractors for testing on a chassis dynamometer. The engines were operated at increasing speed and loads. At each test condition, the sump temperatures was permitted to stablize before the crankcase exhaust gas flow rate and hydrocarbon content were recorded. Gas samples were analyzed by a flame ionization detector. The hydrocarbon emission rate was a direct function of engine fuel rate for all equilibrium engine operating conditions. Hydrocarbon emission rates were very small; expressed in terms of engine fuel rate, the average value for all engines tested was 0.013% and the maximum, 0.04%. Under normal speed-load conditions, crankcase hydrocarbon emission in terms of engine fuel rate was a constant for each engine. It is concluded that diesel crankcase emissions are not a serious air pollution source. Engine service life, wear, and deterioration may increase the hydrocarbon emission rate but not to the extent that countermeasures are required.

1258 APTIC NUMBER 18126

Chironis, Nicholas P.
NOVEL ENGINE CONCEPTS RAISE A NEW CHALLENGE. Prod. Eng., 40(4): 80-84, 86-88, Feb. 24, 1969.

The exhaust fumes emitted by conventional gasoline engines may dangerously contaminate the atmosphere. Therefore, to cope with the air pollution problem, new designs for external combustion engines (Rankine and Stirling cycles) and gas-turbine cycles (Brayton cycles) are being studied. Some of the proposed designs which are presented include hybrid piston-turbine engines, opposing-piston diesel-turbine engines, a 2-cycle engine with a power piston and a charging piston, several steam engine designs, modified Rankine cycles, and modified Stirling cycles. The advantages and disadvantages of these concepts are discussed.

1259 APTIC NUMBER 12311

Committee on Commerce (U. S. Congress)
THE SEARCH FOR A LOW-EMISSION VEHICLE. 91st Congress (Senate), 1st Session, Staff Rept., 149p., 1969. 18 refs.

The effort to reduce carbon monoxide and hydrocarbon emissions from automotive internal combustion engines has increased the problem of nitrogen oxide emissions, indicating a strong need for an alternative source of power. Battery-operated vehicles, at their present stage of development, offer little promise as alternatives. More hopeful is the promotion of an external combustion engine, using steam power. The Rankine vapor cycle propulsion system captures the steam after its use and condenses and recycles it in a closed system. A transmission is not needed, because of the high torque of the engines. A 160 hp engine will accelerate from 0 to 60 mph in 9.5 seconds, as compared with 10 seconds for a 250 hp internal combustion engine (ICE). Reverse torque of the engine can be used to supplement conventional brakes. The Rankine system fits well into the space occupied by motor and transmission in present conventional vehicles. It emits no lead compounds, 20 ppm hydrocarbons, 0.05% carbon monoxide, and 40 ppm nitrogen oxides. The low emission characteristics are 'built-in' and do not depend on supplementary emission controls. Noise is also reduced by a factor of 4 at peakloads. The vehicle can operate on a variety of fuels: e.g., unleaded, low-octane gasoline or low-grade white kerosene. A steam car averaged 20 miles per gallon on kerosene in a test in which ICE vehicles gave 15 miles per gallon. Estimates of the cost of mass-produced steam cars place this at less than the cost of a diesel engine and about equal to a V-8 engine with automatic transmission, but without the cost of a transmission. The steam car is not a safety hazard, since the amount of steam generated at any one time is small and is contained in strong steel tubing. The Rankine engine is hermetically sealed, has a maximum consumption of water or other working fluid of 1 gallon per 1000 miles. Initial startup time is 20 seconds. After initial startup and for about 3 hours thereafter, startup is instantaneous. The California Highway Patrol will test Rankine cycle patrol vehicles. Of the major automobile companies in the USA, only American Motors has expressed an interest in developing Rankine propulsion.

1260 APTIC NUMBER 12481

Construction Research and Development Corp., Los Angeles, Conrad Engineers Div.
INCINERATORS. In: Tenement Refuse Disposal Systems and Artificial Illumination of Communal Areas. Contract PH-940, Section 2, 98p., March 1967. 56 refs.
CFSTI: PB 180879

Despite the advantages of incinerators in a waste burning system, their contribution to air pollution, usually because of incomplete combustion, has led to increased legislation regulating their operation and performance. Incinerators can be built that do not emit pollutants; to accomplish this, any given incinerator should be designed for its particular application. The design requirements of installations for single dwelling or small apartment buildings, rehabilitated tenement buildings, and square blocks of buildings are briefly discussed. Four appendicies are included: the first and second present the portions of New York City and Los Angeles County air pollution control legislation pertinent to incinerators; the third is a reprint of Multiple-Chamber Incinerator Design Standards for Los Angeles County by staff members of the Los Angeles County Air Pollution Control District; and the fourth is the text of a study entitled 'Criteria Used for Upgrading Existing Apartment House Incinerators in the City of New York'.

1261 APTIC NUMBER 12109

Crouse, W. R. and W. E. Flynn
REPORT ON ORGANIC EMISSIONS FROM THE DRY CLEANING INDUSTRY. Bay Area Air Pollution Control District, San Francisco, Calif., 31p., 1968. 6 refs.

The contribution of organic emissions from the dry cleaning industry to the over-all pollution problem in the San Francisco Bay Area was established by a direct mail survey of dry cleaning plants in 1963. Virtually all dry cleaning is performed with three solvents: Stoddard solvent, safety solvent 140, and tetrachloroethylene (also known as perchloroethylene). Stoddard and safety solvent 140 are hydrocarbons obtained from distillation of petroleum fractions; perchloroethylene is a chlorinated hydrocarbon, also referred to as a synthetic solvent. Carbon tetrachloride is no longer in use. The total discharge of organic compounds to the atmosphere by the industry in the Bay Area Air Pollution Control District was 19.8 tons per day in 1963 or 3.8 pounds of solvent emissions per person per year. Most solvent emissions from dry cleaning plants occur between 6 am and 4 pm and peak at 11 am, at a maximum emission rate of 3.1 tons per hour. The efficiency at which dry cleaners conserved solvent varied over a broad range, as did the capacities of the plants. Control equipment for dry cleaning plants using perchloroethylene is commercially available. Carbon adsorption units for solvent recovery are installed in approximatley 30 plants out of 672 for a reduction in solvent emissions of one-half ton per day. (Author summary modified)

1262 APTIC NUMBER 18065

Davis, J. A., B. Clark, and W. A. Gibeaut
GAS INJECTION LOWERS CUPOLA MELTING COSTS, INCREASES MELTING RATES. Foundry, 97(6):66-73, June 1969.

A conventional commercial cold-blast cupola was operated for 10 days under 20 different sets of operating conditions to determine the economic and metallurgical effects of replacing a portion of the regular coke charge with natural gas injected and burned above the regular tuyeres. Several tests were made during which natural gas was burned (mostly with stoichiometric amounts of air) in place of 20, 30, 40, and 60 percent of the normal coke charge. The conventional No. 9 1/2 cupola used in the experiments had a normal melting rate of about 14 1/2 tons per hour with a normal coke charge. The following article details the steps and conditions of the experiment and lists several definite conclusions that can be drawn from the results of the authors' work. A companion paper on the construction and operation of the gas-injection burners will be published in a later issue. (Author's Abstract)

1263 APTIC NUMBER 12120

Duzy, A. F.
AMERICAN COAL CHARACTERISTICS AND THEIR EFFECTS ON THE DESIGN OF STEAM GENERATING UNITS. Preprint, American Society of Mechanical Engineers, New York, 8p., 1959. 13 refs. (Presented at the American Society of Mechanical Engineers, Annual Meeting, Atlantic City, N. J., Nov. 29-Dec. 4, 1959, Paper 59-A282.)

Important coal characteristics are considered with respect to the design of steam generators, including the major components from the coal bunker outlet through fuel equipment, furnace, convection sections, air heaters, and dust collectors. Size content, moisture content, volatile-matter content, calorific value, ash content, and ash-fusion temperature are discussed, together with sulfur content, size distribution, and grindability. Theoretical air requirements are determined for stoker-fired boilers, boilers fired by pulverized coal, and furnace cyclones. Consideration is also given to the deteriorating quality of coal with respect to quantity and characteristics of the ash. The unavailability of cleaner steaming coals will necessitate improvements in metals, methods of controlling obnoxious flue-gas constituents, methods of ash disposal, and steam-generator design.

1264 APTIC NUMBER 11940

Eberhardt, H. and H. Weiand
EXPERIENCES WITH THE NOVEL TILTING-STATE-GARBAGE INCINERATION METHOD IN THE COMPOSTING PLANT AT STUTTGART-MOZHRINGEN. Aufbereitungs-Technik, no. 11:490-494, 1962. Translated from German. 13p.

A tilting-stage garbage incineration plant is described in detail. The tilting-stage grate consists of 12-20 turning, arc-shaped rows of grate rods. By successive tilting of the different rows of grate rods, the garbage is passed downward. The base of the furnace is 6.5 times 2.5 m; its height is 9.9 m. According to the kind of garbage to be processed, this plant can handle up to 220 kg of garbage per hour, with complete burning of the garbage slag. Lack of homogeneity of raw refuse is often a cause of difficulty in incineration. In the plant described, a coarse chopping process with simultaneous mixing of the raw refuse prior to its introduction to the furnace facilitates incineration and increases the performance of the incinerator. A disintegrator is used with advantage for the chopping and mixing. At waste gas temperatures of about 350 C, the values of dust emission from the smoke stack are 0.2-0.5 g/cu m.

1265 APTIC NUMBER 11698

Esso Research and Engineering Co., Linden, N. J.
THE EFFECT OF FUEL VOLATILITY VARIATIONS ON THE PERFORMANCE OF AUTOMOBILES OVER A RANGE OF TEMPERATURES. 156p., April 2, 1968.

The low temperature performance of automobiles and the extent to which it is a function of gasoline front-end volatility were evaluated using a chassis dynamometer installation providing control of ambient air temperature and simulation of vehicle road loading. Cold-starting and warm-up tests were carried out in a group of 20 new 1966 cars. Temperature and/or volatility were varied to cover the performance range from satisfactory to obviously unsatisfactory car operation. Seven fuels were tested and had Reid Vapor Pressures from 13.0-5.2 lbs. and varying volatilities. Start-up performance was found to deteriorate rapidly as volatility was reduced. All the cars started in 4.0 seconds or less with the high volatility fuel at 10 F. Sixty per cent of the cars were unable to start in 4.0 seconds on the low volatility fuel. Cars responded markedly to decreasing front-end volatility during the warming-up period as evidenced by the appearance of flat spots and stalls while attempting to accelerate. The high volatility fuel performed satisfactorily from a flat spot and stall standpoint in all cars at temperatures as low as 15 F. The low volatility fuel required a temperature of 80 F for satisfactory performance in the cars. Lowering the volatility increased the length of time to reach the warmed-up car condition. Seventy per cent of the 20 car group in new car condition had at least a 25% longer warm-up time on the low volatility fuel than on the high volatility fuel. The program also provided a comparison between a group of vehicles equipped for emission control and a group of standard cars. Results showed no significant differences in start-up performance between the 2 groups. Vehicles in the equipped group as a whole warmed-up slightly faster than their counterparts; however, they were more prone to flat spots and stalls. Age was found to be detrimental to car performance.

1266 APTIC NUMBER 17418

Fraser, Thomas W. L. Crentz, and A. L. Bailey
HIGH-SULFUR PITTSBURGH COAL: UPGRADING IN SOUTHWESTERN PENNSYLVANIA AND NORTHERN WEST VIRGINIA. Bull Bureau Mines, no. 483, 70p., 1950. 9 refs.

The upgrading of marginal coking coals was studied. Samples were examined from typical areas of Pittsburgh, with principal emphasis on the problem of sulfur. The main washing problem was the removal of sulfur; the removal of ash is relatively easy. The sulfur problem is increased by the wide variations of sulfur content, not only in the raw coal but in the float product. Within the area studied, low-sulfur coal is found which is adaptable to metallurgical use without washing; areas of high-sulfur coal are also found. Within the two extremes, intermediate areas exist that contain some coal matter of metallurgical quality. A study of the washing characteristics of the coals showed that no one method of cleaning will result in a satisfactory solution of the problem of up-grading the high-sulfur coals. Selective mining, low-gravity separation, fine crushing and froth flotation, and combinations of the three must be employed before sulfur can be significantly reduced. All these methods are difficult to control in the practical operation of producing and washing coal. A study of the washability data showed that the raw coal may be classified with respect to ease of cleaning. Coals containing 1.80% sulfur in the raw product present no extraordinary technological problem. Coals containing 1.81 to 2.27% sulfur in the raw state may be upgraded to metallurgical standards by the development and application of intensive preparatory treatment. Coals of the Pittsburgh bed that contain more than 2.27% sulfur in the raw state cannot be considered as a metallurgical fuel. (Author summary modified)

1267 APTIC NUMBER 12396

Gedgaudas, Marius J.
THE EMISSION INVENTORY AND ITS APPLICATION IN THE IRON AND STEEL INDUSTRY. Preprint, National Air Pollution Control Administration, Raleigh, N. C., Div. of Abatement, 13p., April 1969.

A summary is presented of emission inventory objectives and procedures; an example is given of emission calculations for a hypothetical steel mill, based on published data. The emission inventory data includes techniques for defining study boundaries, selecting a grid system, defining point and area sources, compiling a questionnaire mailing list, estimating fuel and solid waste balances, using emission factors, presenting data, and using results in a control program. Illustrations are given on calculations of emissions from the major operations in a steel mill, including coking, blast furnace, sintering, open hearth, and power plant operations. (Author abstract modified)

1268 APTIC NUMBER 12117

Hagen, D. F. and G. W. Holiday
THE EFFECTS OF ENGINE OPERATING AND DESIGN VARIABLES OF EXHAUST EMISSIONS. Preprint, Society of Automotive Engineers, Inc., New York, 41p., 1962. 9 refs. (Presented at the Combined National Automobile and Production Meetings of the Society of Automotive Engineers, March 12-16, 1962, Paper 486C.)

Engine dynamometer tests were conducted on single and multi-cylinder reciprocating engines to determine the influence of engine variables on the composition of exhaust gas. The engine variables investigated were air-fuel ratio, power output, engine speed, spark timing, exhaust back pressure, valve overlap, combustion chamber deposits, and intake manifold deposits. Hydrocarbon emissions were considerably affected by changes in air-fuel ratio, spark timing, intake manifold pressure, and combustion chamber deposits. Carbon monoxide emissions were principally affected by changes in the air-fuel ratio. Road and chassis dynamometer tests were made to evaluate emission reduction on vehicles with engine component adjustments as indicated by engine dynamometer tests. Carburetion and choke leaning beyond normal specifications produced considerable carbon monoxide concentration reduction. Spark retarding beyond specifications and the use of a device to hold the throttle open during decelerations produced considerable hydrocarbon concentration reduction. Two vehicles with large displacement engines utilizing some of these component adjustments produced concentrations levels of 225 ppm and 170 ppm hydrocarbon and 1.30 mole% and 0.95 mole% carbon monoxide. The extreme component adjustments on the vehicles resulted in a penalty performance, fuel economy, and general engine operation. These vehicles were judged by experts to be commercially unsuitable. Thus far, no vehicles with engine displacements less than 352 cu in. achieved similar concentration levels from the same adjustments. (Author conclusions modified)

1269 APTIC NUMBER 17552

Hansen, Erwin G., P. E. Rousseau, and Henri Rousseau
AN ENGINEERING APPROACH TO THE WASTE DISPOSAL CRISIS. Combustion, 41(9):8-13, March 1970.

Conventional incineration plants in the United States have used a refractory type incinerator with a waste heat boiler installed in the flue outlet. Because of problems of maintenance, corrosion and slagging, and plugging of gas passages, this arrangement has been totally abandoned in European practice. As in the Issy-les-Moulineaux plant southwest of Paris, the incinerator boiler and furnace must be an integral unit. At the French plant, refuse is, in effect, burned in the furnace of a water-wall type boiler. The plant has four units, each designed to burn 39,600 lb of refuse an hour. In operation, collection vehicles discharge refuse to a pit having a two-day collection capacity. The pit is maintained under a negative atmospheric pressure with all combustion air being drawn from the pit. Consequently, no dust spreads to the outside. Wastes are transferred by cranes from the pit to furnace charging chutes. Each furnace contains a Martin type stoker which provides a continuous tumbling of refuse through alternating movement of fixed and mobile bars. Ashes fall by gravity into a water trough from which they are discharged onto a belt conveyor. On leaving the boiler, combustion products pass through electrostatic precipitators with an efficiency of 98%. As a result, smoke emissions from the plant are rarely visible. Steam generated by the boilers is discharged to a back-pressure turbine where it is expanded to approximately 285 psi. This steam is sold to the heating company which serves the center of Paris. In 1967, the plant sold 1,100,000 lb of steam and generated 75,000,000 kw hours of electricity. The incinerated refuse, which contains only 0.1% putrescible matter and 3% unburned carbon (including fly ash), is also sold, generally for road construction. The plant was constructed in 1962 at a cost of $23,000,000. In 1967, operating costs were $1.46 a ton after the sale of steam, electricity, and residue.

1270 APTIC NUMBER 18121

High, D. Dean and W. H. Megonnell
POLLUTION CONTROL: FEDERAL LEADERSHIP. Mech. Eng., 91(2):20-23, Feb. 1969.

Executive Order No. 11282, issued in 1966, requires that all Federal agencies take steps to prevent and control air pollution from their installations. Sulfur oxide emission rates have been established for all Federal facilities in three densely populated cities: New York, Philadelphia, and Chicago. The emission rate of SO_x from combustion units of all federal facilities in these metropolitan areas are 0.35 and 0.65 lb/mill Btu calculated as SO_2.

1271 APTIC NUMBER 17805

Hunt, J. W.
THE TECHNIQUES AND RUDIMENTARY ECONOMICS OF TRANSPORTING LIQUEFIED NATURAL GAS BY SEA. J. Inst. Petrol., 52(508):111-123, April 1966. 4 refs.

The Algeria-U.K.-France LNG project, in which natural gas from Algeria is liquefied and then shipped by tanker to Great Britain and France, is described. Started in 1964, the project is considered a successful commercial venture, the first of its kind. Techniques for liquefaction, shipping, and storage are reviewed. The Algerian plant uses a three-refrigerant cascade type of cycle, although alternative cycles are under development. Ships are of two kinds: the existing free-standing tank design, and the 'membrane system' now being developed in which the cargo is contained by a thin flexible metal lining entirely supported by the surrounding insulation. LNG storage facilities in use or being tested are above-ground double-walled tanks, unlined cavities in frozen ground, below-ground concrete tanks, and mined caverns; the first type is use in Algeria and at the English receiving terminal. The use of the refrigeration potential from the evaporation of LNG at the receiving terminal would greatly enhance project economics if profitably used; possible applications include industrial processes involving the separation or liquefaction of gases, or both. In a discussion of the economics of LNG projects, trends are indicated for capital investments and unit costs over a range of trade volumes and shipping distances. It is concluded that costs must still be reduced below present levels for LNG to remain competitive.

1272 APTIC NUMBER 17745

Jotani, Fumio
COUNTERMEASURES OF AIR POLLUTION CAUSED BY EXHAUST OF MOTOR VEHICLES. (Jidosha haiki gasu ni yoru taiki osen no taisaku). Text in Japanese. Sekiyu Gakkai, Shi (J. Japan Petroleum Inst.), 6(8):620-626, 1963. 53 refs.

Harmful components of automobile exhaust gas are nitrogen oxides, olefins and carbon monoxide. The former two cause significant amounts of smog, including ozone and/or oxidants of hydrocarbons.

The composition of automobile exhaust gas is significantly varied by differences in car, make, engine, age of the car, fuel, and driving conditions. Carbon monoxide, nitrogen oxides, and hydrocarbons increase during idling, acceleration of cruise, and deceleration, respectively. The amount of olefins in the exhaust gas increase with an increase in olefins in the fuel under average driving conditions; thus, the amount of olefins should be smaller. The use of liquid petroleum gas (propane or butane) can decrease smog production, though these liquid gases are expensive. An afterburner is an excellent device to remove harmful components of the exhaust gas by completing its combustion between the cylinder valve and tail-pipe into H_2O and CO_2. The direct flame afterburner uses high temperature, the catalytic afterburner uses low temperature by using catalysts (oxides of Co, Cu, Cr, Mo, W, V, Ni, Pt or mixtures of one or three of them). A chromite catalyst or activated carbon removes nitrogen oxides. The blowby gas emitted from the crankcase is supposed to have 25 to 35% of the total hydrocarbons in automobile exhaust gas.

1273 APTIC NUMBER 17467

Kato, Saburo

A REPORT ON ENVIRONMENTAL POLLUTION PROBLEMS OF KOREA (PART I). (Kankoku kogai Kenbunroku (Zenpen). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 6(3):231-240, March 15, 1970.

Of the various environmental pollution problems of Korea, water pollution is the most serious. Air pollution is of minor importance in the capital, Seoul. There are at least three major reasons for this. Heavy industry is located away from Seoul. Pollution sources are relatively few, since the area is not heavily industrialized. For instance, there is only one thermal power plant (with a 250,000 kw capacity) in the city; this is in marked contrast to the number of thermal power plants with capacities of 8,000,000 kw located along Tokyo Bay. Finally, the number of motor vehicles in Seoul is only 60,000, or contrasted with 1,700,000 in Tokyo. On the other hand, water pollution even in the city is a problem, due to poor sewer facilities. Despite its population of 5,000,000, Seoul lacks a modern sewage system and plants for treating industrial waste water. Of particular significance is the fact that human excrement, used as fertilizer for farming, simply ferments in a receiving tank without biological or chemical treatment, consequently, the rate of infection from parasites, intestinal bacteria, filamentous intestinal bacteria, and fungi among the total population approaches 90%. In rural areas, a great number of people suffer from parasitic diseases. Some projects for sewage treatment are reviewed. Tables and charts indicate river water-pollution levels, factors responsible for air pollution in industries, annual variations in air pollution, annual variations in individual pollutants, results of regional deposit gauge tests, and current trends in air-pollution control administration.

1274 APTIC NUMBER 17471

Knop, Wilhelm
INDUSTIRAL DUSTS AND WASTE GASES. (Industriestaeube und-abgase). Text in German. Wasser Luft Betrieb, 14(2):63-66, Feb. 1970. 22 refs.

The most dangerous and annoying pollutants emitted by various industries are enumerated. Steel mills emit primarily iron oxides and fluorine compounds. Half of the original fluorine input is emitted; the other half goes into the slag. The iron oxide emissions, primarily the small particles below 5 micron, form the brown smoke. The non-ferrous metal fabricating and finishing plants emit metal oxides (cadmium oxide). When inhaled, the latter may be extremely harmful. The TLV (threshold limit value) is 0.1 mg/cu m air. In aluminum production, dust-laden waste gases develop, despite the wet process. The aluminum oxide dust content in the rotary furnace is 300-400 g/standard cu m. In electrolytic reduction of aluminum oxide, cryolite also dissociates. As a consequence, hydrogen fluoride and dusts of fluorine compounds are found in the waste gas. The TLV for fluorides is 2.5 mg/cu m; for hydrogen fluoride, 2 mg/cu m. In lead plants 3 to 3.5 cu m waste gases per kg sinter develop in the sintering and roasting station. They contain 1.5 to 5% by volume SO2 and up to 15 g/cu m dust. The dust contains lead, zinc, sulfur, and small amounts of other elements. Considerable amounts of metal vapors develop. In the fly dust of the shaft furnaces, cadmium oxide or sulfate, arsenic, zinc, and thallium compounds may be found. In copper smelting plants, the waste gases contain fly dust and SO2. In zinc refining, fly dust (0.1 g/standard cu m) and SO2 are emitted to the waste gas. In ferro-alloy production, dusts of various kinds are carried along in the waste gases. The waste gas quantity of a 10 MW furnace amounts to 70,000-250,000 cu m/h; the dust content, to 0.25-2.5 g/cu m.

1275 APTIC NUMBER 12422

Lutz, G. A., S. B. Gross, J. B. Boatman, P. J. Moore, R. L. Darby, W. H. Veazie, and F. A. Butrico
DESIGN OF AN OVERVIEW SYSTEM FOR EVALUATING THE PUBLIC-HEALTH HAZARDS OF CHEMICALS IN THE ENVIRONMENT. VOLUME I. TEST-CASE STUDIES. (FINAL REPORT). Battelle Memorial Inst., Columbus, Ohio, Columbus Labs., Contract PH-86-66-165, 146p., July 1967. 203 refs.

Potential environmental health hazards due to the utilization of mercury, nickel, vanadium, fluorocarbons, and the chemicals used by the pulp and paper industry were reviewed. Pertinent information was identified and selected by examining appropriate subject indexes of journals, abstracts, and current periodicals. The combined activities of collection and evaluation were directed specifically toward the following interpretations: current status of environmental contamination by each of the five contaminants, current status of environment-related medical knowledge of the effects of the contaminant, technological changes likely to lead to the entrance of new contaminants of the selected types, demographic-related changes that would affect the degree of population exposure to the contaminants, and deficiencies in the available information. The studies revealed potentially hazardous situations. Mercury showed a substantial increase in the amount used in the electrolytic production of chlorine. There also exists a lack of fundamental information on national levels of mercury in air, water, and food. The vanadium study showed a significantly increased usage of volatile compounds in industrial applications. The nickel study raised the question of possible chronic effects of small quantities of nickel in food from the use of large quantities of nickel equipment in food processing. A need was demonstrated for the establishment of the environmental fate of fluorocarbons used in aerosols and refrigerants. A review of information on chemical processes employed by the pulp and paper industry demonstrated the need for surveillance of the atmospheric pollutants resulting from increased use of kraft pulping operations. Economics information and the toxicity of the five contaminants were discussed in detail.

1276 APTIC NUMBER 18114

McCartney, J. T., H. J. O'Donnell, and Sabri Ergun
PYRITE SIZE DISTRIBUTION AND COAL-PYRITE PARTICLE ASSOCIATION IN STEAM COALS. CORRELATION WITH PYRITE REMOVAL BY FLOAT-SINK METHODS. Bureau of Mines, Washington, D. C., Rept. Invest. 7231, 18p., 1969. 18 refs.

In an effort to correlate the size of pyrite particles in coal and coal-particle association with the removal of pyrite before burning, the Bureau of Mines conducted a study of 61 coals presently being used for electric power production. The results were obtained by visual microscopic studies of polished briquets of minus 14-mesh samples. Mean pyrite particle sizes ranged from 20 to 400 microns and proportions of pyrite contained in coal particles to an extent greater than 50% by volume (estimated) ranged from 20 to 95%. These parameters were correlated with reductions in pyrite accomplished by float-sink tests at 1.60 sp gr on 14-mesh, 3/8-inch, and 1-1/2 inch samples. The correlation coefficients between pyrite removal and mean pyrite particle size were 0.89, 0.84, and 0.79, respectively, for these samples. Correlation coefficients between pyrite removal and coal-pyrite association parameter were 0.92, 0.90, and 0.85, respectively. It is apparent that extent of pyrite removal can be fairly well predicted from microscopic analysis. (Author's Abstract)

1277 APTIC NUMBER 17576

McKee, Herbert C., John M. Clark, and Ralph J. Wheeler
MEASUREMENT OF DIESEL ENGINE EMISSIONS. Preprint, Air Pollution Control Association, New York City, 7p., 1962. 4 refs. (Presented at the Air Pollution Control Association Annual Meeting, 55th, Chicago, Ill., May 20-24, 1962.)

The emissions of seven different types of diesel engines were measured: experimental four-cycle divided chamber and open chamber engine, with or without turbocharger; one single and one two-cylinder research diesel engine; and a supercharged version of a single cylinder diesel engine. The hygrocarbon content of exhaust and blowby streams was measured by three different methods in order to obtain comparison between them: a non-dispersive infrared gas analyzer with a n-hexane detector; flame ionization analysis detector; and a recording infrared spectrometer and one-meter gas cell. Carbon monoxide and carbon dioxide were measured by the Orsat method, using gas samples collected in evacuated glass bulbs. To obtain some preliminary data on nitrogen oxides, a limited number of grab samples were collected, using evacuated glass bulbs. These were analyzed by the phenoldisulfonic acid method. The hydrocarbon content in diesel engine exhaust and blowby was low compared to that from conventional automobile engines. The values for ethylene and acetylene indicate that the light hydrocarbon gases may constitute a larger proportion of the total hydrocarbon constituents than with automobile exhaust. The flame ionization detector gave the best results, both because it measured total hydrocarbon content and because the instrument was better suited to continuous operation at the low concentrations encountered. The non-dispersive infrared instrument lacked sensitivity. With all methods, condensation of hydrocarbons in the sampling system may represent a substantial source of error in measuring diesel exhaust emissions.

1278 APTIC NUMBER 18082

Meurer, J. Siegfried and Alfred Urlaub
MAN MODIFIED M COMBUSTION SYSTEM BURNS ANY GRADE OF GASOLINE EFFICIENTLY AND WITHOUT KNOCK. S.A.E. (Soc. Automot. Engrs.) J., 77(6):36-41, June 1969. 1 ref.

The FM combustion system combines the mixture formation process of the M system, whereby the liquid fuel is applied to the combustion chamber wall as a film, with spark ignition. An engine employing this system can burn any quality gasoline from the poorest to the highest octane number without knock. The new engine operates at the same low specific fuel consumption as diesels at all loads and speeds, nitric oxide and unburned hydrocarbon emissions are greatly reduced, and carbon monoxide emission is insignificant. As a result output can be increased without exceeding the smoke limit. The development of the design and location of the spark plug is discussed. Test results of the FM engine are tabulated. A comparison of the composition of exhaust gases from a FM engine and from a 4-cyl carbureted engine is presented.

1279 APTIC NUMBER 12377

Millington, B. W.
THE NATURE AND CAUSE OF DIESEL EMISSIONS. Inst. of Mechanical Engineers, London (England), Automobile Div., Symp. Motor Vehicle Air Pollution Control, London, 1968, 5p. 16 refs. (Nov. 25-26, Paper 2.)

The combustion mechanism in a diesel engine differs somewhat from that in a gasoline engine, tending nearer to diffusion flame conditions than premixed flame, as a result of which a higher level of smoke appears in the exhaust. In order to keep the smoke emission within reasonable limits, the diesel engine is always operated at overall fuel/air ratios weak of stoichiometry; this probably contributes to the lower levels of other objectionable emissions such as carbon monoxide, unburned hydrocarbons, and oxides of nitrogen. Continued detail development of the combustion chamber geometry, air flow pattern, and fuel spray distribution should lead to reduced smoke emission, and possibly to reduced HC and CO at the same time. Oxides of nitrogen may be increased by these changes, but on the other hand, chamber configurations are known which materially reduce the NOx levels; chamber developments along these lines could be beneficial. Exhaust recirculation or retarded timing can help, but at a loss in thermal efficiency. Odor is associated with such poor combustion conditions as excessively weak zones in the mixture pattern or unduly late combustion. Appropriate engine development should improve the situation. Carcinogens are only produced in appreciable quantities under very poor combustion conditions; even then, there is little evidence that they are a hazard. Modification of fuel properties may assist in some measure to reduce emissions, but this route appears to have only limited possibilities. (Author conclusions modified)

1280 APTIC NUMBER 17451

Mueller, Herbert and Sieghart von Watzdorf
THE PERCENTAGES OF UNBURNED HYDROCARBON NEAR THE WALL OF THE COMBUSTION CHAMBER AFTER COMBUSTION. (Der Gehalt an Kohlenwasserstoffen in der Naehe der Brennraumwand nach Abschluss der Verbrennung). Text in German. Motortech. Z. (Stuttgart), 29(12):489-499, Dec. 1968. 27 refs.

The combustion processes in the vicinity of the walls were studied with a controllable extraction valve installed in the combustion chamber of reciprocating engine. First results showed a strong influence of various types of wall surfaces on the combustion process in the vicinity of the wall. No explanation for this finding could be given. The analysis of the gases taken from the vicinity of the wall gave no clues. A further series of experiments conducted with the above extraction valve method which had been perfected in the meantime showed that the surprisingly high influence of the various surfaces (gold, silver, copper, and iron were electrolytically deposited) was due to a leak in the valve. Thus no influence of the wall surface on the approaching flame front could be confirmed at constant heat conduction of the wall. Therefore, the fraction of unburned hydrocarbons in the exhaust gas of a combustion engine cannot be influenced by changing the properties of the surface of the combustion chamber wall.

1281 APTIC NUMBER 17462

Murakami, M., T. Kawashima, and K. Kamitsu
INCINERATION PLANT AT ISOGO IN YOKOHAMA CITY. (Yokohamashi seisokyoku isogo kojo ni tsuite). Text in Japanese. Kukichowa Eisei Kogaku (J. Japan Soc. of Heating Air Conditioning Sanitary Engrs.), 44(2):131-138, 1970.

The design and operation of the recently constructed Isogo incineration plant is presented. The plant site area covers 13141 sq m, of which buildings occupy 7330 sq m. The plant is composed of three basements, five floors, a waste dumping building, a charging building, furnace building, central building, and other adjoining buildings. The average yearly incineration capacity is 300 t/24 hrs; the maximum capacity of 450 t/24 hrs is designed to meet seasonal increases in refuse. The plant is characterized by a sanitary working environment and the application of modern technology. The quantity of smoke dust emitted is less than 0.1 g/cu Nm due to the use of multicyclone and electric dust collectors. Effective smoke dispersion is promoted by a chimney height of 85 m; emission speed is more than 20 m/s. An airtight pit chamber prevents the discharge of odors. Waste water is chemically treated to meet water quality standards. At night, noise is suppressed to less than 50 phon. Furnace operations are automated and, like other proceedings, observed on television sets in a control room. Furnace rooms are ventilated 20 times/hr and other rooms between 10 and 15 times/hr. Surplus steam from waste heat in boilers is utilized for a sludge digestion tank and surplus gas, mainly methane, as a subsidiary fuel. The first floor of the plant is 5 m higher than the average tide level of Tokyo Bay.

1282 APTIC NUMBER 12335

Niemeyer, L. E. and F. A. Schiermeier
THE TALL STACK: A QUESTION OF EFFECTIVENESS IN AIR POLLUTION MANAGEMENT. Preprint, National Air Pollution Control Administration, Cincinnati, Ohio, Air Resources Lab., 15p., Nov. 1968.

Studies are being conducted at power plants in western Pennsylvania to define the meteorological conditions under which the effluents from a tall stack are brought to the ground, their frequency of occurrence, the magnitude of the resulting ground-level concentrations, and the effects of the emissions on the agricultural economy of the area. In the meteorological portion of the study, plume rise measurements up to at least 16 km from a stack will be made with a Lidar system consisting of a neodymium laser. To determine sulfur concentrations in a plume, an instrumented helicopter will be flown through a plume in horizontal and vertical traverses at 1 to 5 km from a plant. Measurements of plume dispersion statistics, ground-level sulfur dioxide concentrations, and aereal extent of surface 'fumigations' will be obtained with another instrumented helicopter and portable ground-sampling devices. The procedure is to take a temperature 'sounding' from the surface to 1000 meters or ot an elevation above plume level. Other specialized atmospheric measurements will be made to document the ambient meteorological conditions during an experiment. At selected agricultural sites, the effect of oxidants, sulfur dioxide, nitrogen dioxide, and sulfate on plant yield and growth will be determined. The data will be evaluated with reference to the air quality measurements taken at the site and in terms of distance from the power plants.

1283 APTIC NUMBER 18072

Ninomiya, J. S. and A. Golovoy
EFFECTS OF AIR-FUEL RATIO ON COMPOSITION OF HYDROCARBON EXHAUST FROM TOLUENE, TOLUENE-N-HEPTANE MIXTURE AND ISOOCTANE. J. Air Pollution Control Assoc., 19(5):342-346, May 1969. 29 refs.

This study describes the variations in the chemical composition of the exhaust at various air-fuel ratios when toluene, toluene-n-heptane mixture, and isooctane are used as fuels in a Labeco single cylinder engine. The exhaust products from toluene are divided into three groups: Those which decrease as the equivalence ratio is increased: Toluene, benzene, methane, and dimethylacetylene; those which increase with increasing equivalence ratio: Benzaldehyde, and products which exhibit a maximum at an equivalence ratio of 1, then decrease: Acetylene, ethyl acetylene, ethyl benzene, and styrene. Combustion of the mixture 25 volume percent n-heptane in toluene reveals interesting information, compared to emissions from pure toluene: Concentrations of ethyl benzene, styrene, and dimethylacetylene surprisingly are increased by factors of 1.9, 1.9, and 2.1 respectively, probably because reactive radicals derived from heptane interact with toluene to form unsaturated molecules. Ethyl acetylene, benzene, and benzaldehyde remained unchanged but the fractional mole concentration of unreacted toluene decreased. These results show that fuels rich in aromatics may produce less unsaturates than when diluted with aliphatic fuels. For isooctane fuel, methane, and isooctane in the exhaust decrease as the equivalence ratio is increased, while isobutylene, propylene, ethylene, and propadiene concentrations exhibit maxima at an equivalence ratio of 1. (Author's Abstract)

1284 APTIC NUMBER 11939

Huber, K.
GARBAGE BURNING ACCORDING TO THE DUSSELDORF SYSTEM. Aufbereitungs Technik, no. 5:199-202, 1962. 6 refs. Translated from German. 11p.

An experimental refuse incineration plant is constructed to permit refuse to be constantly loosened, turned, and moving during the incineration process. This allows the plant to handle various types of garbage at any one time and ensures that every single piece finally reaches ignition temperature. The method utilizes a grate construction from large, slowly rotating rollers that are arranged in a series. Air for combustion enters the rollers axially, thus cooling them. The air supply can be regulated for every roller individually. A feed car pushes the garbage in layers into a combustion chamber where it passes from one roller to another. During the process, refuse is turned over several times and loosened again and again. To favor drying and ignition processes, the stream of hot gases is directed against the flow of the garbage. The last roller discharges the burnt residues on a traveling grate. The plant has been operating for one year. During this time, it has handled one-third of all refuse collected in Duesseldorf. The required temperature for the process is 900-100 C, well above limits of odor perception. The ashes that remain are sterile and contain practically no fermentable substances. When graded, they can be used for road construction and similar purposes.

1285 APTIC NUMBER 17788

Petsinger, R. E.
LIQUID METHANE'S METAL: 9% NICKEL STEEL. Gas, vol. 40:65-73, Oct. 1964. 9 refs.

Nine percent nickel is an alloy steel that retains exceptionally high impact properties at cryogenic temperatures. For this reason, the metal is ideally suited for the inner containers of liquid methane above-ground storage tanks of 20,000-bbl capacity and more. The above-ground storage of liquid methane has many advantages. Field constructed facilities reduce site limitations; heat leak and operation costs will be less. With respect to safety, today's nine percent nickel steel tanks feature relief valve systems designed to protect the vessel from errors by operating personnel. The increase in peak shaving requirements has made feasible the use of refrigerated storage for liquid methane. Total capital costs for a 300,000-bbl methane installation are estimated at $2,536,625 and total operating and maintenance costs at $104,000. For inner tank construction, nine percent nickel steel becomes more economical than aluminum at 20,000-bbl. In addition the strength of nine percent nickel steel is superior at both operating and emergency temperatures.

1286 APTIC NUMBER 12122

Pustinger, J. V., Jr. and F. N. Hodgson
INDENTIFICATION OF VOLATILE CONTAMINANTS OF SPACE CABIN MATERIALS. Monsanto Research Corp., Dayton, Ohio, AMRL Contract F33615-67-C-1357, Proj. 6302, Task 630204, AMRL-TR-68-27, 161p., July 1968. 2 refs.
CFSTI, DDC: AD 675177

Fifty-three candidate materials for space cabin construction including various silicones, rubbers, expoxies, and coatings, were tested to establish volatile gas-off and oxidation products. Testing was accomplished by two methods: preliminary screening by thermogravimetric analysis to determine weight loss between 0.001% and 1.0%, exclusive of water, during 24 hours at 25 C to 68 C in a nitrogen atmosphere at 5 psia; and, for materials within this range, storage tests at 68 C for 72 hours and at 25 C for 30 and 60 days in oxygen at 5 psia, followed by analyses of the chamber gases, to determine the nature of the individual components evolved from the candidate material. Those materials falling outside this range were conditionally excluded from further tests. Weight loss data, thermogravimetric curves, gas chromatograms of volatile contaminants, and the nature and quantities of individual components evolved from the candidate materials are reported. In addition to the gas-off experiments, gas chromatographic and mass spectrometric analyses were performed on seven samples of atmospheres from bio-environmental systems. Considerable differences in levels of volatiles were observed. A major contributing factor is the adsorption of volatiles on the chamber walls. Although thermogravimetric measurements are useful, a more direct, measurement of water at the sample site is needed to provide more reliable data. The use of a hygrometer probe at the sample site is recommended. The types of compounds detected included carbon monoxide, alkanes, alkenes, alcohols, alkyl halides aldehydes, ketones, ethers, aromatic hydrocarbons, phenol, and silicon compounds.

1287 APTIC NUMBER 11934

Rasch, R.
FURNACE SYSTEMS FOR REFUSE INCINERATION. (Ofensysteme fuer die Muellverbrennung). Brennstoff-Waerme-Kraft, 16(8):376-382, Aug. 1964. 11 refs. (Presented at the 3rd Muelltechnischen Colloquium of the TH Stuttgart, Feb. 21, 1964.) Translated from German. Iron and Steel Inst., London (England), British Iron and Steel Industry Translation Service, 25p., May 1966.

Various furnace systems for refuse incineration are described and classified in terms of size and type of combustion grating. Grating systems considered are the fixed-grate, the movable grate without agitation, and the agitated grate. Grateless systems are also reviewed; these include the Riepel-Scherer-Ridl Process with slagging, the flame chamber process with slagging, and the Stauff Process with combustion in suspension. It is recommended that special quality liners be provided for combustion chambers because of excessive wear caused by refuse burning as compared with coal. A limit of 100,000 kcal/cu m is set for the fire chamber load. The use of hot waste gases to pre-dry refuse and to reduce combustion chamber temperature is mentioned. Waste gas temperature must be reduced to 350 C to assure proper induced draft and to protect gas purification equipment.' Heat recovery in the form of steam has limited economic importance. Ash removal and post-sintering of refuse ash to produce construction material are also discussed briefly.

1288 APTIC NUMBER 17445

Reichmann, Robert G.
RULE 66: NEW SOLVENTS, PLUS NEW MIL-STANDARDS. Contam. Control, vol. 6:8, 32, Nov. 1967.

Aerospace companies in the Los Angeles area doing business with the Federal government are required to use trichloroethylene or perchloroethylene as degreasing and cleaning agents. However, the Los Angeles Air Pollution Control District's Rule 66, designed to reduce the total amount of unburned hydrocarbons emitted from stationary sources, limits the emission of trichloroethylene from any piece of equipment to approximately 3.2 gals/24 hrs. A program was started, involving solvent manufacturers and the aerospace companies, to find a material that would satisfy Rule 66, the Federal government, and would be useable in existing trichloroethylene degreasers. It was found that 1,1,1 trichloroethane performs as a satisfactory degreasing agent and could replace trichloroethylene economically. The threshold limit value for this solvent is 3500 ppm by volume in air as compared to 100 ppm for trichloroethylene and perchloroethylene. The Federal government is expected to approve its use in any community where air pollution regulations preclude the use of other materials.

1289 APTIC NUMBER 17377

Bowden, E.
OUTSTANDING AIR POLLUTION PROBLEMS. Brit. Clayworker, 78(930):36-46, Nov. 1969. 7 refs. (Presented at the Clean Air Conference, Eastbourne, Oct. 22.)

The most serious pollution problem in the heavy clay and refractories industries is the brown smoke produced by the firing on blue bricks, roofing tiles, and floor quarries and the firing of salt-glazed pipes in intermittent and continuous grate-fired kilns that are hand fired with coal. In recent years, dark smoke emission has been reduced considerably by the incorporation of oil-fired continuous car tunnel kilns or the conversion of continuous or intermittent kilns to oil- or natural gas-firing. To reduce emissions for existing coal-fired intermittent kilns, modifications of the coal-charging procedure are suggested. Other outstanding problems of the industries concern the new minimum kiln chimney height established by the Alkali Inspectorate and the emission of fumes and acid soots. Many existing stacks will need to have height increases or be replaced by mid-1970. If natural gas becomes available, existing chimneys of small height would be sufficient, except when firing high sulfur or fluorine-bearing clays, or where salt glazing is carried out. The acid soot emission is related to the firing of oil in continuous kilns. Methods for its reduction depend on achieving and maintaining efficient combustion, limiting the sulfur content of the fuel or clay, and preventing acid deposition. Fume emissions are more difficult to deal with than smoke emissions. They present serious problems in the firing of fletton bricks and in the firing in continuous kilns of clays containing sulfur and fluorine compounds. A practical commercial solution has not yet been found for this problem.

1290 APTIC NUMBER 17291

Saruta, Namio, Noburu Ishinishi, Yasushi Kodama, Eizaburo Kunitake, Toshio Baba, and Yoko Katori
AIR POLLUTION CAUSED BY EXHAUST GASES FROM MOTOR VEHICLES IN BOTH KITAKYUSHU CITY AND FUKUOKA CITY (II). (Kogyotoshi to shogyotoshi ni okeru jidosha haikigasu ni yoru taiki osen no hikaku --- kitakyushushi oyobi fukuokasji ni okeru jittaichosa kara (II)). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(12):779-787, Dec. 15, 1968. 11 refs.

Two principal types of urban air pollution were recognized by a survey conducted in both industrial and business areas which contrasted each other with respect to social and economic structural differences. Stack smoke from industrial plants is an important constituent of urban air pollution. Concentrations of dust and sulfur dioxide are higher in industrial areas than carbon monoxide. Dust and SO2 concentrations in the proximity of the source decline in proportion to an increase of CO. This result is evidently identified with the transition of types from one to the other. Even lower concentrations of SO2 in industrial air pollution are dangerous when followed with dust. Separately their effects on human health are of less significance. Air pollution in the business area originates in automotive exhaust emissions which have a stimulating affect on the generation of lung cancer because of the lead compound contained in the gasoline. Dust from boiler heating forms an additional part of the urban industrial pollution. These major sources are regarded as factors in the occurrence of photochemical smog. Although two principle types of industrial and business air pollution varies in its source, both its effects on public health can not be graded but are similar in view of enviornmental hygienics.

1291 APTIC NUMBER 11860

Schaffer, S. G. and R. W. Noble
TECHNIQUES FOR THE UTILIZATION OF FLY ASH. Am. Chem. Soc. Div. Fuel Chem. Preprints, 10(1):73-80, 1966. (Presented at the American Chemical Society Division of Fuel Chemistry Symposium on Fossil Fuels and Environmental Pollution, joint with the Division of Water, Air, and Waste Chemistry, Pittsburgh, Pa., March 22-23, 1966.

Fly ash has been utilized with limited success as filling material for asphalt roadways and as a substitute for cement in the production of concrete. Roads with asphalt filling performed well, but this method of utilization would not nearly approach the total amount of fly ash produced each year by the electric industry. Bulk concrete and concrete blocks with fly ash additives in quantities up to 25-30% show good compressive strength, and this method of utilization would provide a market for all fly ash produced. However, several factors limited the marketing of fly ash on so large a scale. Among them are variations in the properties of fly ash from location to location and time to time; the possibility of staining due to the presence of iron; transportation costs; and problems of storage. To date, the most promising method for utilizing fly ash appears to be as a lightweight aggregate. When sintered and crushed, the product can be used as a substitute for fine or coarse aggregate in concrete, concrete block, roadways, and wherever aggregates are required. The advantage of sintered fly ash aggregate is its weight. When sized to concrete block grade, sintered fly ash weighs 48-50 lbs/cu ft. Such a reduction in block weight can mean a decrease in building structure, handling, and shipping costs. Concrete and concrete block using fly ash aggregate greatly exceed minimum strength requirements.

1292 APTIC NUMBER 18078

Seaborg, Glenn T.
LOOKING AHEAD IN NUCLEAR POWER. Mech. Eng., 91(8):30-34, Aug. 1969.

With the prospect of increased future requirements for electrical energy it will be important to utilize all fuel sources wisely and effectively. Current AEC studies are being conducted to examine all aspects of nuclear energy systems--future power requirements, economics, conservation of resources, reactor technology, safety, and the public interest. Various kinds of breeder reactors are being investigated. The economic advantages that might accrue from a strong program for the development of breeder reactors were brought out by a report, "Cost-Benefit

Analysis of the U. S. Breeder Reactor Program," completed recently by the AEC. Environmental factors play an important role in the assessment of the nuclear energy program. Air pollution, thermal pollution, and radioactive discharge are factors that must be kept under control but at a rational level not a level dictated by public hysteria.

1293 APTIC NUMBER 17583

Sellars, J. H., Hornsby-Smith, M. P., M. R. Meades, and G. E. C. Randell
COKE-OVEN TECHNOLOGY. Coke Gas, vol. 23:411-420, Oct. 1961. 2 refs.

One of the three primary sources of smoke emissions in the coke-oven industry is the charging operation. In view of considerable differences of opinion regarding the effectiveness of different charging methods, 200 different charging operations were observed at seven plants. The effects of oven construction, coal characteristics, charging period, coal running period, and levelling period on charging emissions were noted. A Mass Emission Factor (M.E.F.), e.g., the total amount of smoke emitted, was employed to distinguish quantitatively between operational procedures and methods used at the various plants. Low M.E.F. values were due to a combination of factors, such as the use of a rotating chamber for controlled feeding and sequential hydraulic operation of the conventional charging car. The chief conclusion of the survey was the need for adequate suction in the gas space. This can be achieved efficiently and inexpensively by means of the breeches pipe. However, even with improved suction, smokelessness cannot be guaranteed with normal charging methods. The prerequisites for this procedure in which a steam jet in the ascension pipe is used to draw smoke into a gas-collecting main are as follows: adequate pull; adjustment of charging rate in accordance with the pull; means for gas extraction at both ends of the oven chamber; a method of loading the ovens so that a free space exists to each gas offtake; and means for restricting the leveller bar to prevent undue admission of air. In the future, this type of charging should be the normal practice.

1294 APTIC NUMBER 12375

Shigehara, Roger T. and Richard W. Boubel
PARTICULATE AND TOTAL GASEOUS HYDROCARBON EMISSIONS FROM A GAS-HEATED VENEER DRYER. Preprint, Air Pollution Control Association, New York City, 35p., 1969. 15 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 62nd, New York, June 22-26, 1969.)

A source test was conducted to determine the particulate and total gaseous hydrocarbon emissions from a gas-heated veneer dryer. Samples were taken on eight separate days from the exhaust stacks while the dryer was processing Douglas fir veneer. Three of the eight days were used to determine the gaseous hydrocarbon concentration, as measured by a flame ionization detector; five were used to determine gravimetrically the particulate concentration. A statistical experimental design was used for the tests. An analysis of variance of the data yielded average emission rates of 0.97 pound of particulate per hour with a standard deviation of 0.31, and 16.02 pounds of total gaseous hydrocarbons per hour with a standard deviation of 4.09. Because these figures are just for one veneer per dryer, the results should not be assumed valid for all dryers. They show, however, that the emission rate of particulates is not a particular problem. Further study of individual gaseous hydrocarbons from veneer dryers is recommended to determine the proportion of reactive species and to estimate an emission factor so that a dryer's total contribution can be evaluated in an emission inventory. (Author abstract modified)

1295 APTIC NUMBER 18136

Siegmund, C. W. and E. H. Manny
CHANGING PATTERNS OF FUEL OIL--INFLUENCE OF SULFUR REGULATIONS. Combustion, 40(7):36-41, Jan. 1969. 3 refs.

Existing and anticipated air pollution regulations limiting sulfur content are expected to cause changes in fuel oil properties. Many fuel oils from naturally low sulfur crudes will be waxy and will require heated handling facilities or extensive distillate fluxing. Low sulfur fuel oils made by desulfurizing residuum or vacuum distillate will be lower in viscosity than current fuels. Either desulfurized or natural low sulfur fuel oils will be low in ash and asphaltenes which will reduce slagging and stack solids emission. (Author's Abstract)

1296 APTIC NUMBER 12508

Sigsby, John E., Jr.
DISCUSSION OF 'EFFECTS OF AIR-FUEL RATIO ON COMPOSITION OF HYDROCARBON EXHAUST FROM ISOOCTANE, DIISOBUTYLENE, TOLUENE, AND TOLUENE-N-HEPTANE MIXTURE' BY J. S. NINOMIYA AND A GOLAVAY. Preprint, Public Health Service, Cincinnati, Ohio, National Air Pollution Control Administration, 3p., 1969.

An unpublished report on the effects of air-fuel ratio on the composition of hydrocarbon exhaust is evaluated. The study is commended for representing post-combustion products rather than tailpipe emissions and for interpreting data in terms of possible atmospheric reactivity. It is criticized for not measuring exhaust temperature profiles at thermocouples and for providing no data on the formation of aldehydes other than benzaldehyde. Interest is indicated in the effect of synergism shown a toluene-n-heptane mixture on reactivity and in the ability of type 304 stainless steel. To minimize post-combustion effects.

1297 APTIC NUMBER 17277

Spengler, Guenter and Gerhard Haupt
FORMATION OF SOOT AND POLYCYCLIC AROMATIC HYDROCARBONS IN SIMPLE HYDROCARBON FLAMES AND ITS INHIBITION BY FUEL ADDITIVES. (Russ- und Aromatenbildung in einfachen Kohlenwasserstoff-Flammen und

ihre Beeinflussung durch Brennstoffzusaetze). Text in German. Erdoel Kohle (Hamburg), 22(11):679-684, Nov. 1969. 13 refs.

Diesel fuel DEF2405, n-hexane, cyclohexane, benzene, and decalin were burned in a burner in which the fuel from the surface of the liquid was burned with combustion air coming from the outside. The amounts of soot and of polycyclic aromatic hydrocarbons absorbed by the soot and in the gaseous combustion product was determined. The individual polycyclic aromatic hydrocarbons determined were: naphthalene, monomethylnaphthalene, dimethylnaphthalene, acenaphthalene, fluorene, anthracene, phenanthrene, pyrene, fluoranthene, chrysene, 1,2- and 3,4-benzopyrene, anthanthrene, 1,12-benzoperylene, and coronene. In a second series of tests, a 1:1 mixture of n-pentane and acetylene with different metal-bearing (or an organic) additives were atomized in the burner by a nozzle with the aid of nitrogen before coming into contact with the outside combustion air. The individual additives were: methylcyclopentadienyl manganese tricarbonyl, iron pentacarbonyl, iron dicyclopentadienyl ('Ferrocene'), as well as cyclohexanolnitrate. The percent decrease of the amount of soot and of the amount of polycyclic aromatic hydrocarbons adsorbed by it with increasing content of each of the three metal-bearing additives are given. The addition of cyclohexanolnitrate had no effect on the soot formation. A possible mechanism of soot formation and of the action of additives on it is represented schematically.

1298 APTIC NUMBER 17584

Stanfill, Ira C.
MEMPHIS LNG PLANT GOES TO WORK. Am. Gas J., 194(8):19-23, July 1967.

Auxiliary systems, instrumentation, and operation features of the Memphis LNG (liquefied natural gas) plant are described. The flow diagram of the liquefaction and storage process is shown, together with numerous photographs of the installation. A breakdown of control and metering equipment is given. The electrical power facilities and water supply system are also described and safety provisions are reviewed. The plant is operated by a two-man crew.

1299 APTIC NUMBER 18084

Starkman, Ernest S.
ELIMINATING EXHAUST CO AND NO--IT'S POSSIBLE. S.A.E. (Soc. Automot. Engrs.) J., 77(7):28-29, July 1969.

Control of CO and NO emissions from the combustion process of a spark ignition engine can be achieved by burning a lean fuel mixture. The result would be to bring CO and NO into the 1:1 relationship that supports the chemical reaction in the presence of suitable catalysts that produces the more innocuous nitrogen and carbon dioxide. This means solving the problems associated with running an engine on lean mixtures so that the maximum time is spent at the CO-NO match point.

1300 APTIC NUMBER 17787

Sterrett, Elton
HOW LIQUEFIED NATURAL GAS IS STORED IN 'FROZEN EARTH.' Butane Propane News, vol. 23:47,56-57, Dec. 1961.

A new method of storing liquefied natural gas entails precooling an earthen pit (through evaporation of the liquid natural gas spray) to -260 F, introducing the liquid into the pit first by gravity and then by a vapor-lift system, and hermatically sealing the pit with an aluminum cover. The liquefied gas is retained in the pit only by the surrounding frozen earth. During tests of a pilot pit 20-ft in diameter, no gas leaks were detected when the pit was operated under a pressure of 10-in. wc. Since mounting a pump in an earthen pit would introduce foundation and sealing problems, a vapor lift principle was also adopted for emptying the pit. In this type of lift, the flow is set up by applying a vacuum at the receiving end of the pipe. The vapor and liquid thus obtained are separated and the liquid is fed to a pump. Estimates on an earthen storage pit center around $1.00 a barrel, depending somewhat on the type of soil encountered. Pits up to 10-ft in diameter are feasible, with working depths dependent on soil conditions.

1301 APTIC NUMBER 17542

Takahashi, Kanji
ENVIRONMENTAL POLLUTION DUE TO ATOMIC ENERGY DEVELOPMENT. (Genshiryoku kaihatsu ni tomonau kankyoosen). Text in Japanese. Doboku Gakkaishi (J. Japan Soc. Civil Engrs.), 55(2):41-42, Feb. 15, 1970. 5 refs.

The release of radioactive substances from atomic power plants in the U. S. is discussed with reference to protecting the environment against radioactive contamination. Control measures center on the diluted low-level waste, the radioactivity of which is only a fraction of that of total radioactive substances. These radioactive substances are mainly nuclear fission products generated by nuclear power plants; their release to the atmosphere is accompanied by the release of radioactive air-cooling and corrosive substances. Concerning radioactive substances in the air and drinking water, the maximum density of over 200 kinds of nuclei is restricted by law. Similarly, restrictions are placed on the amount of radioactive wastes that can be emitted by a plant. Air pollution by atomic power plants is less than that by thermal power plants. However, atomic power plants release considerable quantities of tritium. Fortunately, tritium is not particularly hazardous, and tritium emissions will not be an important air pollution problem in the near future. However, consideration must be given to its long half-life.

1302 APTIC NUMBER 12430

Taylor, F. R., Z. G. Tomaras, and W. E. Scott
EMISSIONS FROM FUEL OIL COMBUSTION (FINAL REPORT). Scott Research Labs., Inc., Perkasie, Pa., SRL Proj. 1009c, 40p., March 1, 1963. 8 refs.

A survey was made of the stack emissions from 25 residential heating units of various designs using No. 2 fuel oil and 4 industrial units burning No. 6 fuel oil. Emissions of the pollutants by the industrial units were comparable to the emissions from residential units except for sulfur dioxide which was proportional to the sulfur in the fuel. Ethylene and acetylene were specifically indentified from the hydrocarbons emitted and were measured by infrared absorption. By concentrating the emissions after warm-up in cold traps and separating the hydrocarbons and oxygenated hydrocarbons by gas chromatography, specific information was obtained. Hydrocarbons in the C4 to C6 range, saturated or unsaturated, were found in concentrations of less than 4 parts per billion for 17 of the 25 residential units. average total concentration on hydrocarbons in the C5 to C12 range was found to be about 25 parts per billion and the average total concentration of oxygenated hydrocarbons was about 10 parts per billion. Fluorescence spectrometry showed that under normal operation, fuel oil No. 6 produced particulates containing negligible quantities of polycyclic aromatic hydrocarbons. When the burner was operated under non-ideal combustion conditions, particulates were produced containing at least 11 polycyclics which included benzo(a)pyrene. It was found that 15 of the residential units emitted less than 8% CO_2, which was attributed to leaky fire boxes. Periodic maintenance to reduce the infiltration of air into the combustion chamber would not only increase the over-all efficiency of the unit, but also minimize the production of polycyclic aromatic hydrocarbons resulting from incomplete combustion. (Author summary modified)

1303 APTIC NUMBER 17783

Vaughan, Harold E.
LIQUEFIED NATURAL GAS PROJECTS TODAY. Hydrocarbon Process Petrol. Refiner, 44(3):131-136, March 1965.

Six worldwide gas liquefaction projects are reviewed, with special emphasis on a pioneer frozen in-ground storage facility. The liquid natural gas in the in-ground container will be at -259 F and under 10 ounces pressure. With this positive pressure, air cannot enter the storage container and, therefore, a combustible mixture cannot form. The highest level of the liquefied natural gas will be two ft below the top of the ground level to eliminate the risk of spillage. During peak periods, liquefied gas will be pumped from the container, vaporized by the addition of heat, measured, odorized, and admitted to the main pipe line. The vaporization facilities will be capable of vaporizing up to 200,000 Mcf per day. This gas will be admitted to the main line at not less than 50 F. The in-ground container, which extends from 6 ft below the ground to 13 ft above ground level, is a circular wall installed in a hole approximately 115 ft in diameter. Freeze pipes surround the container, providing a barrier structurally strong enough to support the walls and to keep water out. The roof of the container is nine percent nickel steel.

1304 APTIC NUMBER 17464

REMARKABLE MEASURES FOR THE IMPROVEMENT OF AIR QUALITY. (Beachtliche Massnahmen zur Verbesserung der Luft). Text in German. Wasser Luft Betrieb, 14(1):33-36, Jan. 1970.

In 1967, a total of 4 million tons of sulfur dioxide were emitted from industrial sources, particularly power plants. Until 1975, an increase to 5 million tons is anticipated; from then on, the SO_2 emission will stagnate and eventually decline, due to the use of nuclear power. Contrary to this downward trend, fluorine, chlorine, hydrocarbons and numerous odorous pollutants are on an upward trend, due to the expanding chemical industry. In the metallurgical industry, the sinter capacity has been doubled; thus, the larger units will emit HCl and larger quantities of gaseous fluorine compounds along with SO_2. It is estimated that sintering plants presently already emit as much fluorine compounds as the aluminum plants. No fluorine removal method from the waste gases of the ore sintering plants is yet available. Traffic will further increase, as well as vehicle emissions. Emissions by domestic heaters will decrease because electric or central heating will take the place of old coal or oil fired heaters. To combat the increasing pollution of air by an overall increase of emissions, the state of North-Rhine-Westphalia plans to establish emission inventories. Such inventories have been made in the area around Cologne; other large cities will soon follow.

1305 APTIC NUMBER 17516

Watanabe, Goro, Masaharu Murakami, and Keimi Yamawaki
COUNTER-MEASURES TO AIR POLLUTION AND KURE WORKS (CONCERNING MAINLY THE MEASURES TO BE TAKEN AGAINST THE PUBLIC HAZARDS CAUSED BY SO_2). Kure-seitetsusho ni okeru taikiosen ni tsuite. Shutoshite SO_2 no kogaitaisaku ni tsuite). Text in Japanese. Nissshin Seiko Giho (Nisshin Steel Tech. Rept.), no. 17:33-54, Nov. 1967. 6 refs.

Air pollution becomes a particularly serious problem when many large industrial plants are concentrated in one area. In the case of Kure iron works, there is no real danger of a large-scale air pollution because of the small amounts of waste gas, but localized pollution is a problem, due to the complex topography of the plant site and the closeness of a residential area. After an investigation of air pollution by sulfur dioxide around the Kure works, it became clear that localized pollution involved the down-draught of exhaust fumes and that the phenomenon was caused by the topographical situation. The main source of the exhaust fumes was the sintering plant. A subsequent review of control methods indicated the advantages of a tall chimney for obtaining adequate diffusion, and wind-tunnel tests were conducted to determine the stack height required. A height of 100 m was found to the sufficient for normal weather conditions but not for special conditions such as a temperature inversion. Therefore, a stack 120 m high is being built.

1306 APTIC NUMBER 16133

Weigel, James E. and E. George Sabino, Jr.
SOLVENCY AND SOLVENT RETENTION STUDIES FOR COMPLYING VINYL SOLUTION COATINGS. J. Paint Technol., 41(529):81-88, February 1969. 11 refs.

Solvent systems for vinyl solution coatings have been significantly affected by the West Coast air pollution control regulations. Basic solvency information that has been developed to permit the formulation of complying vinyl systems is discussed. Data are shown which relate the composition of solvent systems to viscosity of vinyl chloride-vinyl acetate copolymer solutions. Solution properties of non-exempt and complying versions of vinyl solutions are compared. A gas-liquid chromatography method for the determination of retained solvents in dried films cast from these solutions is described. Data developed by this method is shown which relates solvent retention to solvent volatility. (Author's Abstract)

1307 APTIC NUMBER 18132

Williams, K. R.
THE CHALLENGE TO THE GASOLINE ENGINE. Petrol. Rev., 22(264): 375-378, Dec. 1968.

The gasoline engine, which is cheap, light, flexible, and readily refueled is likely to remain the prime mover of cars for some time to come. However, the fuel cell as a source of electricity, which offers high efficiency, silence, and freedom from atmospheric pollution may challenge it. Electric systems, hybrid systems, and fuel cell systems are discussed from the point of view of vehicle specifications, cost of energy, and power requirements.

1308 APTIC NUMBER 18131

Winkler, G. L., S. S. Lestz, and W. E. Meyer
EXHAUST GAS SAMPLING TECHNIQUE FOR RELATING EMISSIONS AND CYCLE CHARACTERISTICS. Society of Automotive Engineers, Inc., New York, 8p., 1968. 10 refs. (National Fuels and Lubricants Meeting, Tulsa, Okla., Oct. 29-31, 1968.)

Cycle-to-cycle variations of the combustion process of spark ignition engines, usually observed as peak pressure variations, are a phenomenon whose causes have not yet been identified with certainty. For investigating whether or not there is a relationship between physical cycle characteristics, such as peak pressure, and exhaust gas composition, a sampling system was developed which collects bag samples from specified cycles only. It consists of an analog portion for obtaining pressure and rate-of-pressure change signals, a digital logic portion for discriminating between signals according to selected criteria, and an electrically actuated sampling valve in the engine exhaust system. Since signal analysis and discrimination are instantaneous, gas sampling is done during the exhaust stroke of the same cycle for which the logic generated the command to sample. The system is described in detail and its use is illustrated with an example. (Author's Abstract)

CONTROL METHODS

1309 APTIC NUMBER 12516

Atkisson, Arthur A., Jr.
NATIONAL MOTOR VEHICLE CONTAMINANT CONTROL REQUIREMENTS: AN EVALUATION OF 'BLOWBY' CONTROLS AS A MEANS OF REDUCING VEHICULAR CONTAMINANT EMISSIONS. Preprint, Air Pollution Control Association, New York City, 18p., 1961. 27 refs. (Presented at the Air Pollution Control Association Annual Meeting, 54th, New York, June 1961, Paper 61-90.)

One of the currently available techniques for reducing total vehicular contaminant losses involves the use of blowby controls to prevent emissions from crankcase vents and breather tubes on gasoline-powered motor vehicles. Two alternative blowby control devices were installed on approximately 100 vehicles owned by Los Angeles County and their performance evaluated in road draft tube tests. One device consisted of a variable orifice valve and vent tube system which vents the crankcase fumes to the intake manifold. The second consisted of a tube which vents the fumes from the crankcase directly to the carburetor air cleaner. The first type costs from five to ten dollars; the second costs approximatley one-fifth of that amount. During the evaluation program, more than two million road miles were accumulated on the test vehicles. There were no complaints about the test devices. No sticking or plugging of the variable orifice valves occurred. No adverse engine operating conditions were reported as the result of drawing blowby fumes through the carburetor. The lack of complaints is attributed to the fact that a fuel oil used possessed a detergent. Either of the two device systems is capable of meeting the California crankcase emission standard which requires an approximate 80% control of blowby losses. However, a combination of the two types would result in a control system with virtual 100% efficiency. Such a system would also minimize the probability of control failure resulting from the clogging of a single vent tube or orifice valve, thereby detering the need for an official inspection program.

1310 APTIC NUMBER 12842

Atsukawa, Masumi
CONTROL AND REMOVAL OF SULFUR FROM THE FLUE GAS OF A LARGE SCALE COMBUSTION PLANT. DRY PROCESS OF SULFUR OXIDE REMOVAL FROM FLUE GAS, USING ACTIVATED MANGANESE OXIDE. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 2(1):37-38, 1967. Translated from Japanese. 8p.

An activated manganese oxide absorption process for removing sulfur oxide from flue gases was investigated with successful results in pilot-plant studies conducted by two power companies. The process, which removes both SO2 and SO3 and yields ammonium sulfate, combines absorption with dust precipitation, absorbent regeneration, and ammonium sulfate crystallization. Homogeneous dispersion of the pulverized absorbent is obtained by mixing it first with a part of the main flow of gas and then adding it at high speed to the main gas flow. Since the tower contains no filler, power requirements are reduced. Manganese sulfate formed during the reaction, together with unreacted manganese oxide, flue-gas soot, and ash, are collected in a multicyclone and electrostatic precipitator. The collected materials are returned either to the absorbing tower or are converted to slurry for use in the regeneration process. The absorbent is regenerated in the oxidation tower by treating the slurry with aqueous ammonia under about 5 atm air. The slurry discharged from the oxidation tower is separated into an ammonium sulfate solution and recovered absorbent. The former is then introduced to the crystallization process and the lattor is reintroduced to the absorption process. An advantage of the method is that the structure and capacity of a boiler are unaffected, since the process is applicable to normal flue gas temperatures.

1311 APTIC NUMBER 17744

Atsukawa, M.
WORLD TREND IN SO2 REMOVAL METHODS FOR AIR POLLUTION CONTROL. (Sekai ni okeru SO2 jokyo-taisaku no doko). Text in Japanese. Kagaku Kogyo (Tokyo), 18(12):1185-1192, Dec. 1967.

The control of sulfur dioxide as practiced by seven countries, including the U.S.A. (5 governments, 4 electric companies, 7 petroleum companies, 2 mines, 4 chemical industrial companies, 7 engineering companies, and 2 universities) is reported. Air pollution caused by SO2 is supposed to be much more severe 5 to ten years from now, although SO2 removal methods have always been behind the economical advancement. The systematic world trend in SO2 removal at the present time is represented by the following organizations: National Center for Air Pollution Control in U.S.A., CONCAWE in Netherlands and VDI in Germany. (There is no special information for these systems.) Any of the methods of the above organizations require high-leveled techniques and excellent equipment. In addition to the production of sulfur, H2SO4, and NH4SO4, the advancement of other sulfur compounds should be needed. The following specific methods are mentioned: Limestone-dolomite injection process, alkalized alumina, catalytic oxidation, and the manganese oxide process.

1312 APTIC NUMBER 12391

Bailey, C. L.
THE INFLUENCE OF MOTOR GASOLINE CHARACTERISTICS UPON CARBON MONOXIDE EMISSIONS UNDER ENGINE IDLE CONDITIONS. Inst. of Mechanical Engineers, London (England), Automobile Div., Symp. Motor Vehicle Air Pollution Control, London, 1968, 9p. (Nov. 25-26, Paper 16.)

In order to identify the important fuel characteristics influencing carbon monoxide exhaust emissions, five vehicle systems were tested with four experimental fuels which provided variations in viscosity, volatility, carbon/hydrogen ratio, and specific gravity. A fifth, a reference fuel, was included for comparison purposes. Because of the unavailability of test equipment, the experiments were confined to the idle mode only. Full test data are presented. The only influential fuel characteristics was front end volatility defined by R.v.p., volume distillate to 70 C, and/or the temperature difference between the 10 and 20% distillation volumes.

The variable jet carburetors examined showed increased CO emissions with increased volatility, whereas the fixed jet carburetor and fuel injection system showed reduced CO with increased volatility. The effect observed in the vehicle fitted with the fixed jet carburetor was very much less pronounced than the effect observed in the vehicles fitted with a variable jet carburetor. Statistically significant laboratory effects of the same order of magnitude as the fuel effects were measured during the test work. (Author conclusions modified)

1313 APTIC NUMBER 17782

Barnhart, Donald H. and Erle K. Diehl
CONTROL OF NITROGEN OXIDES IN BOILER FLUE GASES BY TWO-STAGE COMBUSTION. J. Air Pollution Control Assoc., 10(5):397-405, Oct. 1960. 9 refs. (Presented at the Air Pollution Control Association 52nd Annual Meeting, Los Angeles, Calif., June 22-26, 1959.)

The results are reported of a program to control concentrations of nitrogen oxides, particularly nitric oxide, in flue gases from power plants burning residual fuel oil and natural gas. Preliminary development considerations and investigations are described; the latter were carred out using a water-cooled tunnel 12 ft in diameter and 22 ft long, designed to accomodate and test full-size burners. The introduction of a portion of the combustion air through the burners, and the remainder at some point beyond the burners, is the underlying principle of one method of reducing nitric oxide formation, termed 'Two-Stage Combustion.' This method, with auxiliary-air ports above the burners, was effective while still maintaining acceptable boiler performance; with minor changes to the burner, a total nitric oxide reduction of 56% was achieved when firing oil at full load. Similar results can be expected in gas firing. It appears that additional reductions would be possible if the air flow through the burners were reduced another 5 or 10%.

1314 APTIC NUMBER 18067

Basye, Dale
HOW HUMBLE CONTROLS ITS ENVIRONMENT AT BENICIA. Oil Gas J., 67(12): 102-105, March 24, 1969.

An extensive environmental study of the area around the proposed site of its new Benicia refinery was commissioned by Humble Oil & Refining Co. before construction was started. The basic purpose of the study was to establish a base line, reflecting the state of water and air quality, vegetation, soil, and climatic conditions. Samples were collected and chemically analyzed. Meteorological conditions, including wind, climate, and inversions, were measured. The site characteristics and design precautions taken to minimize pollution effects are discussed.

1315 APTIC NUMBER 12192

Beutner, Heinz P., Walter R. Wiesson, Henry E. Haley, and William S. Emerson
FEASIBILITY OF A REGENERATIVE HIGH TEMPERATURE AMINE ABSORPTION PROCESS FOR THE CONTROL OF SULFUR DIOXIDE EMISSIONS FROM STACK GASES. Little (Arthur D.) Inc., Cambridge, Mass., Contract Ph 86-68-57, 88p., Aug. 1968. 3 refs.
CFSTI: Pb 180233

Sulfur dioxide undergoes an irreversible disproportionation reaction which prevents its recovery by thermal means during regenerative high temperature amine absorption process for the control of SO2 emission from stack gases. The irreversible reactions in the amine-SO2 system were explored as well as potential methods of chemically recovering the sulfur values. The disproportionation reaction produces primarily dithionate as well as tri- and pentathionate. The sulfur values can be recovered by resin or liquid ion exchange; by precipitation of the sulfur anions as insoluble salts; and by reduction, oxidation, or disproportionation to sulfur compounds which can be easily isolated. Overall, SO2 absorption from flue gases in amines in the temperature range of the flue gas (200 to 300 F) is conceptually feasible. A suitable amine for this process is tetraethylenepentamine. Engineering cost estimates for an 800 megawatt power plant showed that some processes employing chemical regeneration might be attracted economically. For instance, precipitation of the sulfur species with lime, assuming a credit for the resultant salt equivalent to the value of the contained sulfur, involves operating costs of 0.08 mills/kwh; resin ion exchange and recovery as ammonium sulfate involves an operating cost of 0.04 mills/kwh; and liquid ion exchange extraction leaves an operating credit of 0.07 mills /kwh.

1316 APTIC NUMBER 17740

Bogatyrev, Vladimir L'vovich
MIXED-BED APPLICATIONS OF ION EXCHANGERS. In: Mixed-Bed Ion Exchangers. (Ionity v Smeshannom Sloye). Moscow, Khimiya Press, 1968, Chapt. 4, p. 137-209. 233 refs, Translated from Russian. Joint Publications Research Service, Washington, D. C., 92p., June 10, 1969.
CFSTI: JPRS 48200

The absorption of gases and vapors are among the reviewed uses of ion exchange bipolar reagents (i.e., mechanical or molecular mixtures of cation and anion exchangers) in chemical research and production processes. The advantages of the ion exchanger for separating purifying, and analyzing gases are as follows: high specific capacity compared with ordinary physical sorbents; chemical stability and adequate bead strength; simplicity of regeneration; and ability to be given any chemical form necessary for reacting with a particular gas or group of gases. Ion exchangers in mixed bed form are used when simultaneous absorption of two or several gases of varied chemical nature (e.g., CO2 and NH3) is required; for mixtures of gases of the same kind but having different chemical properties (i.e., absorption based on different mechanisms; and also for trapping aerosols (SO3, NH4CL).

halogenides, etc. The appropriate ion exchangers behave toward acidic and basic gases as typical bases and acids, and interact with them in neutralization reactions. Studies of absorption by ion exchangers of basic gases (particularly ammonia), acidic gases, and iodine vapors are reviewed. It is concluded that the most universal absorbents are mixtures of highly ionized monofunctional ion exchangers (KU-2, AV, etc.). Carboxyl cation exchangers and anion exchangers containing secondary and tertiary amino groups are apparently more effective in absorbing strongly basic and acidic acids; coarse-porous exchangers are best for vapors of organic compounds of large molecular size and also for combinations of chemical and physical sorption. Absorption of noxious gases (NH_3, HCl, SO_2, etc.) is expected to be one of the major applications of ion exchangers as gas absorbents.

1317 APTIC NUMBER 12308

Borgwardt, Robert H., Thomas A. Kittleman, and Larry G. Turner
THE DRY-LIMESTONE PROCESS FOR SULFUR DIOXIDE CONTROL: A FIELD STUDY OF THE ROLE OF OVERBURNING. Air Pollution Control Association, New York City, 19p., 1969. 10 refs. (Presented at the Air Pollution Control Association Annual Meeting, 62nd, New York June 22-26, 1969.)

Two series of injection tests for desulfurization of flue gas were made on a boiler. The boiler fired No. 6 fuel oil containing 2.3% sulfur at a rate of 10,000 pounds oil/hour at an operating load of 150,000 lbs steam/hour. Four different additives (2 limestone and 2 dolomites) were used. During the first series of tests, the effect of boiler load on the degree of burning of additives injected with the fuel was investigated. During the second series, the influence of particle size, iron content, residence time, and injection temperature on the effectiveness of the additives was studied. The dry-limestone process should not be applied by injection with the fuel; additives must instead be injected separately to achieve efficient utilization of the limestone. Overburning is at least partly responsible for the low efficiencies found when additives are fed to the burners. The lime produced by injection with the fuel is much less reactive with SO_2 than lime that is not calcined in the combustion zone. Boiler load was an important variable affecting desulfurization when additives were fed with the fuel. This was due to the higher excess air used during low load. The tests indicated that there is an optimum particle size as well as an optimum injection temperature. Injection temperatures somewhat higher than 2400 F would be best for 2-micron particles.

1318 APTIC NUMBER 17738

Boswell, Jerry
NEW DESICCANT FOR GAS DEHYDRATION. Gas, vol. 44:52-53, June 1968.

The properties and advantages of KA-201, a new desiccant for use in dehydration towers at natural gas compressor stations, are described. KA-201 is an active alumina desiccant in spherical form rather than the conventional granular pattern used in recent years. It has a surface area of 380 sq m/gm, a packed bulk density of 47-48 lb/cu ft, dynamic sorption of 21-22%, state adsorption of 21-22% at 60% relative humidity, and abrasion loss of 0.2%. The alumina can be pneumatically bulk loaded in less than one-third the time required for bag loading a dehydration tower and with far less manpower, a feature producing significant cost savings for users of solid-type desiccants. KA-201 retains a high degree of activity after repeated regenerations, even when contaminating media such as olefinic gas or monoethanolamine are present. Round-shaped desiccants seem to minimize pressure drop in gas drying, and packing and channeling are minimal. When designing for a given pressure drop, use of a spherical desiccant permits deeper beds and more efficient use of material. Only where extreme poisoning or fouling conditions exist does the capacity of KA-201 decrease at an accelerated rate.

1319 APTIC NUMBER 12248

Calvert, W. R.
AIR CAN BE CLEANED (FOR BREATHING). Naval Ship Research and Development Center, Annapolis, Md., Material Lab. TN-275, Assignment 823-107-40, 17p., Dec. 1968. 2 refs. (Presented at the Air Pollution Control Association Annual Meeting, St. Paul, Minn., June 23-27, 1968, Paper 68-157 and the 61st Annual Meeting of the American Institute of Chemical Engineers, Dec. 1-5, 1968, Los Angeles, Calif., preprint 45C.
DDC: AD 680432

Since adsorption is capable of regenerative separation and removal of unwanted gases which contaminate air, adsorption with heat removal was studied with a newly developed Chamber 3 (patents pending). The chamber has water cooled walls to rapidly remove heat from the adsorbent bed by short distance conduction, radiation, and convection. The adsorbent is annular with a jacket (through which the water flows) on the outer periphery of the annulus. A 0.75-inch tube with open-end is the central cold wall in the annular bed. This tube receives a bayonet cooler or a bayonet heater according to the requirements of a test run. Between the bayonet and the 0.75-inch tube, an annular clearance of about 0.020 inch serves as a conduit. During adsorption, this conduit carries the contaminated air from its inlet to the space beneath the perforated grid which supports the weight of the adsorbent bed while distributing the contaminated air uniformly over the cross-sectional area of the annual bed's bottom. Tests with chamber 3 showed that although heat removal was inadequate, data sufficient to demonstrate chromatographic separation of clean air from contaminants were obtained with an attractive improvement in adsorbent capacity. Nitrogen conservation is possible. At adsorption temperature, an oxidation catalyst may become adsorbate-laden, requiring desorption before oxidation can start. After desorption, O_2 and fuel are separated from the feed stream by adsorption during oxidation. Heat accumulation is necessary to cause propagation of the reaction, and then oxidation is complete. The catalyst $Pt/Al_2O_3.H_2O$ was found to be least susceptible to adsorption inhibited oxidation of CO and H_2.

1320 APTIC NUMBER 17568

Campbell, W. W. and R. W. Fullerton
HIGH-ENERGY WET SCRUBBERS CAN SATISFACTORILY CLEAN BLAST FURNACE TOP GAS. American Inst. of Mining, Metallurgical and Petroleum Engineers (AIME), New York, N. Y., Proc. Am. Inst. Mining Met. Petrol. Engrs. Conf. Blast Furnace, Coke Oven, Raw Materials 1969, vol. 18:329-335.

Data on the operation of high-energy wet scrubbers for dust-cleaning blast furnace gas at three steel plants is summarized. High-energy wet scrubbers, if properly designed, can clean blast-furnace gas to a degree that is acceptable for gas-fired auxiliaries. Also, the dust content of the resulting products of combustion will comply with smoke-control ordinances. The cleaned-gas dust loading varies inversely as the pressure drop across the scrubber; the pressure drop is affected by both gas flow and scrubbing-water rate. The effect of water rate on pressure drop is not as pronounced for an orifice scrubber as for a venturi scrubber. For a given pressure drop, cleaner gas will be obtained with a venturi scrubber than with an orifice scrubber. Operating costs (exclusive of those based on capital expenditure) would be essentially the same for both types of scrubbers. Little maintenance is expected for either unit. A rate of at least 5 gal of water per 1000 cu ft of gas is required to satisfactorily clean blast furnace gas with either type of scrubber. Higher water rates will result in higher pressure drops, and hence cleaner gas. The final choice between an orifice and a venturi will depend on the desired gas cleanliness, on the extent to which the top pressure of the furnace can be increased, and on whether the extra cost of the venturi could be offset by the lower stove and boiler maintenance costs which it affords. (Author summary modified)

1321 APTIC NUMBER 18079

CAN H_2S STACK GAS BE EASILY RECOVERED. Can. Chem. Process., 53(8): 56-57, Aug. 1969.

A process for selective absorption of H_2S from gas streams containing high proportions of CO_2 utilizes a strong sodium carbonate/bicarbonate solution. The solution is in equilibrium with the CO_2 in the stack gas. By maintaining pH at about 9.0 and oxidizing the absorbed sulfide ions, the H_2S is converted to thiosulfate, sulfate, or sulfide ions. A patent (Can. 806,071-C. Oloman, F. E. Murray, J. B. Risk) was granted to the B. C. Research Council. Possibilities for use of the process either in a kraft pulping operation or in a petroleum refinery are being explored.

1322 APTIC NUMBER 17457

Chute, A. E.
SULFUR FROM PETROLEUM GASES AND LIQUIDS. Trans. AIME (Am. Inst. Mining, Metallurgical, and Petroleum Engr.), 241(3):314-318, Sept. 1968. 8 refs. (Presented at the Society of Mining Engineers Fall Meeting, Rocky Mountain Mineral Conf., Las Vegas, Nev., Sept. 6-8, 1967.)

Since 1963, sulfur consumption has exceeded production. As a consequence, the price of sulfur has risen from a low of $18 per ton in 1962 to about $46 per ton in mid-1967. The increasing role of recovered sulfur in the sulfur market is discussed. Originally a by-product of the removal of hydrogen sulfide from natural and petroleum refinery gases, recovered sulfur today is often the product of a multiproduct processing facility. The two major sources of recovered sulfur are liquid petroleum and natural gas production and refining processes. Sulfur from these sources is produced in the form of gaseous hydrogen sulfide which is removed from a gas stream and converted to elemental sulfur. Estimated investment and operating costs for typical two-converter plants are presented in the form of graphs. The data indicate that in reasonably sized plants, a considerable margin exists between the selling price and the cost of conversion. A two-converter process plant permits recoveries as high as 96%. However, considerable attention is now being given to three converter plants to achieve conversions up to 98% or higher. Another potential source of sulfur is SO_2 in tail gases. Once recovered, the SO_2 can be effectively combined with hydrogen sulfide in a modified Claus process to provide elemental sulfur. If SO_2 recovery processes can be made to approach 100%, the stack pollution problem would be virtually eliminated.

1323 APTIC NUMBER 17124

SO_2. IS IT A HEALTH HAZARD UNDER NORMAL CONDITIONS? WHAT ARE THE PRACTICAL APPROACHES TO CONTROL? Coal Age, 73(4):72-81, April 1968.

Ground-level concentrations of sulfur oxides rarely are of a magnitude constituting a health hazard. Power and industrial plants do not add to existing levels when equipped with tall stacks to insure upper-air dispersion and dilution. Other control approaches include removal of the oxides from stack discharges and solvation and conversion of coal. The Dept. of Health, Education, and Welfare recommends that the SO_2 in the atmosphere in populated areas not exceed an average of 0.1 part per million parts of air more than 1% of the time over a 24-hr period. There is a growing tendency throughout the country to require very low sulfur contents in coal and fuel oil or to forbid their use completely in favor of some other source of heat; nuclear is preferred, with natural gas as another choice. Various comments are made by various notables that no ill effect had ever been recorded for less than 2 ppm, some 20 times the proposed HEW criterion. It is claimed that because SO_2 is one of the most easily measured of the foreign substances in air, it is frequently used to describe air pollution; British experience has shown that other substances are far more harmful.

1324 APTIC NUMBER 17557

Darley, Ellis F. and John T. Middleton
CARBON FILTER PROTECTS PLANTS FROM DAMAGE BY AIR POLLUTION.

Florist's Rev., vol. 127:15-16,43,45, Jan. 12, 1961. 7 refs.

A combination activated carbon filter-cooler is described for use in greenhouses, where adequate summer cooling is required along with filtration to prevent photochemical plant damage. The unit is constructed so that both the carbon and dust filters can be easily and properly sealed in place without requiring the individual to bolt frames usually supplied with them, thus lowering initial costs and permitting easier inspection and replacement. The air is at ambient humidity when it passes through the carbon, and the moisture-laden cool air does not contact the carbon. The unit also has a feature which, by the use of a steam-heat coil, minimizes uneven temperatures in the house and prevents cold injury to plants near cooling ducts.

1325 APTIC NUMBER 12125

Davis, D. L. and G. E. Onishi
CATALYTIC CONVERTER DEVELOPMENT PROBLEMS. Preprint, Society of Automotive Engineers, Inc., New York, 8p., 1962. (Presented at the National Automobile Week Congress, Detroit, Mich., March 12-16, 1962, Paper 486F.)

A research and development program on catalytic converter system designs is discussed with respect to controlling automotive exhaust, along with details of specific problem areas encountered, methods used in their solution, and an outline of remaining unsolved problems. Data are presented to show the effect on conversion efficiency of catalyst bed configuration, catalyst temperature, auxiliary air, and gasoline additives. Catalyst warmup rate and more effective utilization of available exhaust heat are considered, and performance of several catalysts under various automobile operation conditions are illustrated. Suggestions are offered for maintaining adequate catalyst efficiency for 12,000 miles. This might be achieved by developing a catalyst that will not be affected adversely by additives in the gasoline or by providing sufficient heat in the catalyst bed to promote a high degree of conversion, even after contamination. (Author abstract modified)

1326 APTIC NUMBER 18077

Debus, Henri R., Raymond M. Cahen, and Rene L. Aga
FOR BETTER JET FUELS OR SOLVENTS. Hydrocarbon Process., 48(9): 137-140, Sept. 1969. 3 refs.

A new hydrotreating process has been developed to help meet the growing demand for better jet fuels and for dearomatized solvents. The process, based on aromatics saturation through hydrotreating, operates with essentially conventional hydrotreating procedures using a highly active sulfur-resistant catalyst. The process is suitable for treating petroleum distillates boiling between 140 degrees and 660 degrees F and generally containing between 5 and 30% aromatic hydrocarbons. Kerosines and jet fuels with smoke points up to 44 min and solvents with less than 1% noxious aromatics can be produced.

1327 APTIC NUMBER 12152

Elliott, Jack H., Norman Kayne, and Mark F. Le Duc
EXPERIMENTAL PROGRAM FOR THE CONTROL OF ORGANIC EMISSIONS FROM PROTECTIVE COATING OPERATIONS. (FINAL REPORT). Rept. no. 8, Los Angeles County Air Pollution Control District, Calif., 147p., June 1962.

This report concludes an investigation into the feasibility of controlling organic vapors released into the atmosphere from surface coating operations. The effectiveness of activated carbon for controlling organic vapor emissions in commercial and industrial spraying operations where concentrations range from 100 to 200 ppm is evaluated. Capital and operating costs for facilities with exhaust volumes of 1000 to 50,000 cu ft per min are estimated. Previously reported findings regarding approaches to control, results of pilot operations of activated carbon adsorption units, and the development of analytical methods are also summarized. Technical feasibility of adsorption methods was demonstrated; 90% of the organic emission from a single source was recoverable. One batch of activated carbon was used for 1928 hours without apparent decline in adsorptive qualities or changes in size or appearance. The use of filters to properly prevent contamination by solid particulate matter in the over-spray of the coating operation could extend the adsorption life considerably. The value of recovered solvent is sufficient to cover operating costs of only the larger units. The analytic method developed is satisfactory for source testing and for determining compliance or non-compliance with proposed control regulations.

1328 APTIC NUMBER 17212

Enke, Gg.
RETROSPECT OF THE TECHNICAL SHOW 'KEEPING AIR CLEAN' IN DUESSELDORF: AIR ENGINEERING EQUIPMENT FOR THE GLASS, ENAMEL AND CERAMIC INDUSTRY. (Rueckblich auf die Fachausstellung 'Reinhaltung der Luft' in Duesseldorf: Lufttechnische Einrichtungen fuer die Glas-, Email- und keramische Industrie). Text in German. Glas Email Keramio Tech., 20(12):427-429, Dec. 1969.

New designs or improvements of equipment by various companies, exhibited at the Duesseldorf show 'Keeping Air Clean', were as follows: a 'KM2' concentration meter which measures gas concentrations and signals when preset values are reached; an Auer Ex-Alarm monitors, a closed space for combustible gas; a gas sampler for temperatures up to 900 to 1100 C; a dust monitor FH62-A; a flame-ionization detector; and a 'Microgas MSK-SO2' for SO2 measurement and recording. All-metal catalysts oxidize, for example, the vapor of a solvent present in the waste gas of a drying oven. A bubbling absorber removes, for example, HCl-bearing waste gas from a HCl pickling plant. Schnakenberg absorbers remove SO2-[illegible]ng waste gas or odoriferous substances, and the like. Air cleaner systems remove chemical vapors, gases, dust, and can be built of stainless steel. The 'HKL' air cleaner works on the wet principle and can be built for temperatures up to 300 C. 'VDS' wet dust separators work on the venturi principle and the water can be recirculated many times without a water pump. The lamellar separator is formed at two or more sets of equidistant lamellae placed at an angle to the direction of the impinging gas stream and separates, with or without recovery, droplets, mists, aerosols and dusts from utility or waste gases. Fabric filters attain degrees of dust removal of 99.9% and higher, the residual dust content of the filtered air or gas being less than 25 mg/cu m. Some gas filters work at temperatures up to 250 C and have automatic pressure-difference cleaning. The 'BHS-Downflow-Area Filter' has a continuously scanning cleaning nozzle, leaving more than 90% of the filter area in service at all times.

1329 APTIC NUMBER 18111

Ergun, Sabri and Ernest H. Bean
MAGNETIC SEPARATION OF PYRITE FROM COALS. Bureau of Mines, Pittsburgh, Pa., Rept. Invest. 7181. 25p, Sept. 1969. 30 refs.

Previous studies of magnetic separation of pyrite from coals have been reviewed critically. Magnetic susceptibilities of United States coals of differing rank have been measured. The effects of crushing, magnetic mixing, drying, weathering, and heat treatment on the enhancement of the magnetism of pyrite have been analyzed. The importance of size distribution of pyrite in the coal and the necessity of crushing to liberate the pyrite has been discussed. (Author's Abstract)

1330 APTIC NUMBER 18066

Franzel, H. L. and D. W. Miller
CLEANER STACK GASES ARE A BONUS. Oil Gas J., 67(12):95-98, March 24, 1969. 5 refs.

Experience with specially designed high-efficiency third-stage centrifugal separators at four Shell refineries has proved that atmospheric losses of catalyst particles from fluid-cracking units can be held to extremely low levels. Catalyst loading and size distribution affect the discharge, however, the results approximate those achieved by an electrical precipitator downstream from a two-stage conventional cyclone system. Operated in conjunction with energy recovery systems the high efficiency separators can also recover power as an added bonus. The mechanical energy recovered can result in before taxes payouts as low as 1-1/2 yr at new fluid cracking units, or about 3 yr where systems are added at existing units.

1331 APTIC NUMBER 17806

METHOD OF PRODUCING GASEOUS OR LIQUID SULFUR DIOXIDE FROM A GAS OR FROM GAS MIXTURES. (Mode de production d'anhydride sulfureux gazeux ou liquide a partirde gaz oude melanges gazeux). Text in French. (Edeleanu G.m.b.H., Berlin, Germany) French Pat. 725,253 5p., Feb. 11, 1932. (Appl. Oct. 19, 1931, 8 claims).

A procedure is presented for absorbing gaseous sulfur dioxide contained in other gases by bringing them into contact with liquid organic compounds containing nitrogen in such a manner that SO2 can be absorbed by them. Aliphatic or cyclicamines, hydroxylamines or hydrazines, and heterocyclic nitrogenized compounds such as pyridine or quinoline can be used as absorbing agents. The SO2 gas absorbed is driven off by heating and the released SO2 gas is liquefied by cooling. To prevent the formation of double compounds of SO2 and the absorbing agents used in its crystallization, alcohol, cetones of the aliphatic or the cyclic series, or, simply, water is added to the latter. To recover the SO2 driven off from the mixture of hydrocarbons with liquid SO2, the organic absorbing agents are used to absorb the SO2 vapors; they are then driven off again from these agents by heating. The invention can be applied to refrigeration units working with SO2 which are thus transformed into refrigeration units of the absorption type.

1332 APTIC NUMBER 17854

Fukusaki, Michiyuki
RESEARCH AND DEVELOPMENT OF DESULFURIZATION OF FUEL GASES. (Haiendatsuryu gijutsu no kenkyu kaihatsu jokyo). Text in Japanese. Anzen Kogaku (J. Japan Soc. Safety Eng.), 8(5): 257-265, Oct. 15, 1969. 13 refs.

Preventive measures for eliminating sulfur dioxide in waste gases are urgently needed. Japanese oil companies have practiced fuel desulfurization since 1968; however, the desulfurization of fuel gases, for which the removal rate of sulfur is higher and the expenses are cheaper, is still under development. Over 100 kinds of processes have been devised in the U. S., England, and Japan. In Japan, more than 10 kinds of methods were developed by governmental agencies and private industries. The desulfurization of fuel gases can remove over 90% of the sulfur and compounds such as SO2, H2SO4, and H2S. A large sum of money is expended for the fuel gas desulfurization research in advanced nations. If research efforts continue, new and better processes should emerge in the near future. The major systems of desulfurization employed in the U. S. and Japan are reviewed, including electrostatic precipitation, alkalized alumina, scrubbers, and alkaline additives.

1333 APTIC NUMBER 17750

Funke, G.
POLLUTION AND NUISANCE CONTROL ACTIVITIES. (Aus dem Arbeitsgebiet Emissionen). Text in German. Zement-Kalk-Gips (Wiesbaden), 57(5):209-219, May 1968. 9 refs. (Presented at the Technical Meeting of the Vereins Deutscheer Zementwerke, Karlsruhe, Germany, Sept. 27, 1967.)

Dust removal equipment in the cement industry has improved. Multicyclones can be efficiently used to collect dust from cooler exhaust air if blockage and excess wear are prevented. Mixing-bed filters with increased operational reliability are also used for dust collection from cooler exhaust air. New developments are fluidized bed filters and hot-gas dry filters with mineral wool as the filter medium. Longer filter fabric life was attained with new types of cleaning mechanisms. Electrostatic precipitators are not always in continuous operation due to unfavorable gas and dust conditions which produce a limit of 150 mg/N cu m. Precipitators are also affected by corrosion of the internal fittings and filter chambers. Electrostatic precipitators for rotary kilns with air suspension preheaters should be equipped with evaporative coolers in order to cool and moisten gases when direct kiln operation is employed. Regulations aimed at combating noise will necessitate measures to reduce noise, particularly in wet-process plants. The vibrations caused by blasting in quarries are continually measured in order to enable the requisite technical precautions for reducing the vibration velocities to be established. (Author summary modified)

1334 APTIC NUMBER 17439

Girsewald, Conway Freiherr von, Gerhard Roesner, and Max Wohlwill
METHOD FOR THE RECOVERY OF THE VAPOROUS FRACTIONS OF ORGANIC BASES IN THE WASTE GAS DEVELOPING IN THE ABSORPTION OF SULFUR DIOXIDE BY ORGANIC BASES. (Verfahren zur Rueckgewinnung der bei der Absorption von Schwefeldioxyd durch organische Basen im Abgase des Absorptionsvorganges in Dampfform mitgefuehrten Anteile der organischen Basen). Text in German. (Metallgesellschaft A. G., Frankfurt (W. Germany)) W. German Pat. 703,676. 4p., May 23, 1937. (4 claims).

In the absorption of sulfur dioxide from roasting gases with organic bases such as aromatic amines (aniline, toluidine, or xylidine) or with mixture of these substances with water, fractions of the organic bases are carried along in vaporous form by the waste gases. These vaporous bases can be recovered by scrubbing with an organic liquid having a low vapor pressure in which the organic base is dissolved. The latter is converted to sulfite with SO_2 in the presence of water. The sulfite dissolves in water. High-boiling refined mineral oils can be used as the scrubbing fluid. Refined paraffin oil with a boiling point between 235 and 240 C was very suitable. The viscosity of the fluid should not be more than 2 degrees Engler at 50 C. The gases carry enough water to dissolve the sulfite forming at the scrubbing process. If this is not the case, water must be added to the organic solvent prior to and/or during the reaction with SO_2. The organic base is separated from the scrubbing fluid; the latter is returned for re-use. Gas and scrubbing fluid are passed counter-current through the scrubber, which may be a packed or a spray tower.

1335 APTIC NUMBER 11854

Goldschmidt, Klaus
EXPERIMENTS IN THE USE OF WHITE LIME HYDRATE AND DOLOMITE LIME TO DESULFURIZE FLUE GASES FROM OIL-AND PULVERIZED COAL-FIRED FURNACES. (Versuche zur Entschwefelung von Rauchgasen mit Weisskalkhydrat und Dolomitkalkhydrat bei Oel-und Kohlenstaub-Feuerung). Fortschrittber. VDI(Ver. Deut. Ingr.) Z., Ser. 6(21), 133p., Aug. 1968. 47 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 138p.

The suitability of white lime hydrate and dolomite lime hydrate to desulfurize flue gases was tested by mixing the additives with pulverized coal by injecting them into the combustion chamber above the burner of a furnace heated with pulverized coal and oil. The experiments confirmed theoretical predictions that, due to the short residence time of flue gases and additives in a furnace, complete desulfurization is not feasible. Direct mixing of coal and additive caused formation of eutectic melts during combustion, leading to heavy caking of the furnace. Only small amounts of sulfur dioxide were bound by additive surfaces. A higher desulfurization rate was achieved by injecting the additive into the zone of the furnace where temperatures of about 1000 C prevailed. White lime hydrate was more satisfactory than dolomite lime hydrate, since the additive contains fewer impurities and the decomposition pressures of calcium sulfate are lower at constant temperature than those of magnesium sulfate. The best desulfurization results were obtained with oil-firing. Here, the additive depositions on the rear heating surfaces continue to bind SO_2 and are the major factors in the totally achieved desulfurization rate. Despite this, only 50% of the SO_2 was bound.

1336 APTIC NUMBER 18123

Gordon, David and David Standley
PROTECTING INTERIORS FROM POLLUTION. Architectural Eng. News, 11(1):30-31, Jan. 1969.

Air pollution, commonly thought of as an outdoor problem, also affects the quality of indoor air. To properly control interior pollution, the entry route of the pollutants must be determined and pollutant control must be an integral part of the design. Some of the methods of controlling pollutants are discussed. A tabular comparison of the characteristics of stack gas treatment is presented.

1337 APTIC NUMBER 17776

Grenier, Pierre
SOLVENT COUNTER-DIFFUSION IN GAS ABSORPTION. Can. J. Chem. Eng., 44(4):213-216, Aug. 1966. 17 refs.

The usual design equations for absorption towers are based on the assumption that only one component is diffusing in the gas phase; the counter-diffusion of the solvent is ignored. A correction factor is developed, based on a solution of the Stefan-Maxwell diffusion equations for the case of two gases diffusing through a stagnant third one. The special case of equimolal counter-diffusion is also considered. The correction factor is obtained by simultaneously solving two non-linear equations. The system ammonia-water-air is used to illustrate the order of magnitude of the error the factor is intended to correct. (Author abstract modified)

1338 APTIC NUMBER 17209

Gropper, Sergiu
EJECTOR FOR THE ELIMINATION OF NOXAE. (Ejector pentru eliminarea noxelor). Text in Romanian. Mecanizarea Electrificarea Agr., 13(2):64-65, Feb. 1968.

Ventilation equipment presently used in small Romanian workshops are not effective in removing dust created by grinding equipment, since they are located on the ceiling of the room and are only capable of removing lighter-than-air gases. Thus, the atmospheric dust tends to exceed legal limits for industrial safety. A local ventilation system is described which, when placed near the dust-producing device, completely eliminates the dust, using economic amounts of air. (In Rumania, the cost of an electric ventilation system would be prohibitive for small shops.) The device functions by entraining the noxae from a stream of compressed air as it passes through a venturi tube, made from a metal plate 1 mm thick. Dust and other impurities are removed from the airstream by means of a water bath filter.

1339 APTIC NUMBER 11613

Harstad, J. Bruce and Melvin E. Filler
EVALUATION OF AIR FILTERS WITH SUBMICRON VIRAL AEROSOLS AND BACTERIA AEROSOLS: EFFECT OF VELOCITY, PARTICLE SIZE, AEROSOL CHARGE, AND HIGH HUMIDITY. Dept. of the Army, Frederick, Md., Commodity Development and Engineering Lab., Proj. 1B622401A072, Misc. Pub. 29, 68p., May 1968. 7 refs.

CFSTI, DDC: AD 673121

A study to determine the effectiveness of commercial air filters in removing microbial organisms from air streams is described, primarily for white room and microbiological applications. Filters from three manufacturers were evaluated with submicron T1 bacteriophage aerosols having a number median diameter (NMD) of 0.12 micron and with aerosols of bacterial spores with an NMD of 1 micron. The filters included ultra-high-efficiency all-glass and glass-asbestos filter papers and the filter units fabricated from these filter papers. Velocity, aerosol particle size, aerosol charge, and exposure to high humidity affected the performance of ultra-high-efficiency air filters. Penetration of submicron phage aerosols through ultra-high-efficiency filter papers increased markedly with an increase in velocity. Neutralizing phage aerosol with bipolar air ions resulted in two- to fivefold increases in penetration with the larger increases occurring at the lower velocities. Penetration of bacterial spore aerosols through the filter papers was essentiall zero. The filter papers were more effective against microbial aerosols than the filter units fabricated from these papers. Submicron phage aerosol penetration through the filter units averaged 0.00095%. The comparable value for spore aerosols was 0.00005%. Exposure to high humidity that simulated conditions under which filter units are decontaminated with steam-formaldehyde resulted in roughly a threefold increase in penetration. Ultra-high-efficiency filter units can be expected to provide excellent protection against submicron viral aerosols as well as against bacterial aerosols. Although aerosol particle size, aerosol charge, air flow, and exposure to high humidity had significant effects on filter performance, they are of secondary importance compared with the manufacturer's quality control. Performance of filter units is mainly a function of fabrication rather than the efficiency of the filter paper. (Author abstract modified)

1340 APTIC NUMBER 17433

Hartmann, F. and G. Koeck
ABSORPTION EXPERIMENTS WITH A BUBBLE SCRUBBER. (Absorptionsversuche mit einem Blasenwascher). Text in German. Chem. Ing. Tech., 37(3):214-218, 1965. 2 refs. (Presented at the Jahrestreffen der Verfahrens - Ingenieure, Basel, Switzerland, Oct. 4-7, 1964.)

The proposed bubble-scrubber has the characteristics that the gas to be cleaned is distributed in the scrubbing liquid by so-called 'mixing ejectors' and that the fast liquid mixture moves with considerable speed through the reaction column proper in developing the design of a mixing ejector, the configuration was sought which would give a good bubble bed and would suck in the largest amount of gas per unit of liquid used at a given driving pressure. The effect of the following factors were studied experimentally using air and water: shape of the driving nozzle, subdivision of jets, jet angle with respect to the nozzle axis, jet diameter, mixing chamber diameter and diameter of the reaction diameter. Nine of the experimental ejector designs are shown, in addition to the performance characteristics of the adopted design. In subsequent tests, carbon dioxide was absorbed by aqueous solutions of potassium carbonate from CO2 + air mixtures according to the reaction: K2CO3 + H2O + CO2 equals 2KHCO3. The CO2 content of the different CO2 + air mixtures used was measured by a gas chromatograph before and after interaction. The K2CO3 content of the different absorbent solutions used was determined by electrochemical titration with 1N HCl before and after interaction. These solutions were regenerated by heating. In two series of tests, the voluminar mass transfer coefficient, in K moles/cu m hr, was determined as a function of the specific wetting rate, cu m/sq m hr at two different initial K2CO3 contents of the liquid solution in val/l, and the partial pressure of CO2 in the gas mixture in torr at two different degrees of conversion. The coefficient increases with increasing specific wetting rate and decreasing normality of the solution; it decreases with increasing partial pressure of CO2 and with increasing degree of conversion.

1341 APTIC NUMBER 17525

Hashimoto, Kiyotaka
THE POINT OF PLANNING AND ITS EFFECT ON OPERATION RESULT OF AN ELECTRIC PRECIPITATOR IN VARIOUS INDUSTRY SMOKE ABATEMENT (VI) -- FLUE GAS TREATMENT AT REFINERIES (I). (Gyoshubetsu ni miru denkishujinsochi no setsubikeikaku to untenkoka. (VI) Seirenjo ni

okeru haigasu no shori (I)). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(5):303-309, May 15, 1967.

Vaporized substances from a melting furnace become oxidized when they come into contact with air and are cooled. The oxidized substances form a metallic dust which has surface area out of proportion to its weight. This dust damages clothing and curtains. Furthermore, the dust is high in electric resistivity and poor in water-absorbency. Its removal in an electrostatic precipitator requires that the relative humidity of the waste gas be high. Smoke abatement in several typical nonferrous-metal refining processes is described. Among the points considered are Weltz-kiln dust control in zinc refining, dust control in zinc re-refinement from the slag of copper refining, alloying furnace dust recovery, and cadmium recovery from zinc refinery waste gases. Zinc waste gas is effectively purified in electrostatic precipitators. In precipitating lead dust, the relative humidity of the gas should be over 40%. An automatic regulator is suggested for lead dust. Dust generated by titanium oxide refining is worth recovering as a final product; this dust is easily treated in an electric precipitator when precipitated at high temperatures. For sulfur trioxide control, it is necessary to cool the gas and precipitate the dust as a mist. For optimum precipitation of copper refinery dust, care must be taken to avoid air leaks.

1342 APTIC NUMBER 17537

Hashimoto, Kiyotaka
THE POINT OF PLANNING AND ITS EFFECT ON OPERATION, RESULT OF AN ELECTRIC PRECIPITATOR IN VARIOUS INDUSTRY SMOKE ABATEMENT (VIII). TREATMENT OF WASTE GAS IN CHEMICAL, GAS, PULP, AND OTHER INDUSTRIES. (Gyoshu betsu ni miru denki shujin sochi no setsubi keikaku to untenkoka (VIII)-kagaku gasu parupukogyo to ni okeru haigasu shori). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(8):475-482, Aug. 15, 1967. 15 refs.

In the chemical industry, dust removal is necessitated in the production of sulfuric acid and carbide. Because these waste gases vary so in nature, the electrostatic precipitation must be operated under various pressures. The collected dusts are either in the solid or liquid state. In the manufacture of phosphoric acid, dust is ordinarily removed after gas hydrolysis. Defects in dust removal techniques are rarely a source of air pollution problems in the gas industry, but gas leaks can cause extensive damage. Because the gas is not accompanied by smoke, it is difficult to detect. There are some important gas refining operations, such as the removal of ash and carbon from gas originating in the thermal decomposition of coal or crude petroleum and the removal, refining and fractionation of the fluid catalyst in synthetic gas. For industry, the recovery of valuable materials is economically important. Waste-gas purification in the pulp industry does not always require a set form of precipitator, but an electric one is economically advantageous. In this case the material is precipitated by a dry process, while the collected materials are treated in a completely wet process or in a half-wet process in which the hydro-collection is discharged to a cleaning hopper.

1343 APTIC NUMBER 17519

Hashimoto, Kiyotaka
THE TREND AND PROBLEMS OF AUTOMATIC CONTROL IN GAS CLEANING TECHNIQUE. (Jogin-sosa no jidoseigyo to sono mondaiten). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(4):212-222, April 15, 1967.

In considering dust removal systems the continuously changing character and condition of waste gas and dust, including mists, must be recognized. The character and condition of the gas effects the efficiency of the dust removal system not only in the stationary state but also in the transitional condition. For optimium efficiency in a dust removal system, automatic controls must be introduced to regulate the changes in gas condition. Automatic controls make it possible to improve precipitation capability, prevent decreases in the rate of dust removal in ash-off operations, maintain safe operating conditions, reduce expenses for power, labor, and repairs, monitor the purity of waste gas and water, and increase the amount of valuable material recovered. Proper maintenance is essential for any type of precipitator. For instance, in a filtering system, the accumulated dust must be taken off at a proper point of air resistance, though this point is not easily determined. In an electrical system, the best control is achieved by determining the effective value of precipitation voltage. Automatic control systems for both dry and wet electrostatic precipitators are described.

1344 APTIC NUMBER 11617

Haver, F. P., K. Uchida, and M. M. Wong
RECOVERY OF SULFUR FROM MOLYBDENITE. Bureau of Mines, Washington, D. C., Rept. of Investigations 7185, 15p., Oct. 1968. 10 refs.

The Bureau of Mines developed a process to extract about 90% of the sulfur from molybdenite flotation concentrate by compacting the concentrate with one-quarter of its weight of aluminum powder, heating it at 800 C for 30 minutes, and then allowing the product to react with water. This thermite reduction yields an impure molybdenum alloy plus aluminim sulfide. The latter readily hydrolyzes, to yield pure hydrogen sulfide which can be converted to elemental sulfur by the Claus process. At least 95% of the molybdenum can be subsequently recovered as 99.95-percent-pure molybdic oxide. (Author abstract modified)

1345 APTIC NUMBER 17455

Hejma, Jiri
MODEL VERIFICATION OF OPTIONAL SIZES OF THE BOXES OF MULTICYCLONES. (Modelove overeni optimalnich rozmeru skrini multicyklonu). Text in Czech. Zdravot Tech. Vzduchotech., 11(3):113-120, 1968. 1 ref.

Model verification of cyclones was studied with respect to the effect of size and shape of the box on the separability of the box and on the pressure loss in the separator; determinations were made of the distribution of dust in individual cyclones. The measurements were done on a model of separator SDC 64 (in scale 1:5) which is the biggest mutlicyclone of type D with 64 cyclones and for which the worst distribution of dust is expected. The box was manufactured in three sizes with cells instead of cyclones. The distribution of air flow quantity in cells was uniform. The flow analysis confirmed that the size of the box used is good and that the cyclone block has to be moved as much forward in the box as possible to decrease turbulent flow just behind the entrance. The distribution of dust in individual rows of cells is acceptable (45-170%).

1346 APTIC NUMBER 17746

Hipkin, A. S.
CLEANING OF FUME FROM ARC FURNACES. In: Air and Water Pollution in the Iron and Steel Industry. London, Iron and Steel Inst., 1958, p. 108-114. (SP-61.)

Brief comments are made concerning the requirements of the Clean Air Act in relation to pollution by industrial processes. Information collected on pollution from furnaces is reviewed. Experience of application of equipment to arc furnaces and types of fume-cleaning plants available are outlined. With open-hearth furnaces, the temperatures and quantitative measurements of the air-gas mixtures are known and under control. With arc furnaces, fume escapes through all openings in the shell and roof, and also at the joint between shell and roof ring if the furnace is not in good condition. Fume emission also varies with different furnaces depending on their design, operation, and the type of steel produced. Plants have been installed for extraction of the fumes emitted from arc furnaces without any attempt to collect the solids. These plants have proved effective in producing reasonable working conditions but they have also transferred pollution from the melting shop to the outside air. Whether the principle of direct extraction when producing alloy steel is metallurgically acceptable or not, the advantages of fume control indicate that the method should be carefully considered whenever possible. Types of collectors available include simple cyclones, multi-cyclones, wet arrestors, Venturi scrubbers, bag-type filters, and electrostatic precipitators. Each has merit as a collector, but not all are suitable for application to arc furnaces. In recognition of the Clean Air Act, it is suggested that the cleaning of furnace fume is a process calling for research and experience.

1347 APTIC NUMBER 17463

Hoeke, Bert and Horst Arnim Wittbold
WASH SOLUTION FOR PURIFYING FLUORINE-CONTAINING WASTE GASES IN ALUMINIUM INDUSTRY. (Waschloesung zur Reinigung fluorhaltiger Abgase in der Aluminiumindustrie). Text in German. Wasser Luft Betrieb, 14(1):24-29, Jan. 1970. 7 refs.

The separation of fluorine compounds and dust from waste gases of aluminum plants was studied in the laboratory. A suitable scrubbing liquid was determined for the waste gas; the developing compounds had to be soluble to avoid crystallization in the dust collectors and on pipes. Four test series were carried out with a rotating wet collector. The fluorine compounds could be removed to a large extent with an alkaline scrubbing liquid. A slight dependence of the degree of efficiency on the pH value of the scrubbing liquid was observed. At pH 8 to 12, the gaseous fluorine compounds could be removed to a residual concentration of less than 0.5 mg/standard cu m. The salt content of the circulating scrubbing liquid increased in the course of the experiments to a maximum of 64 g salt/liter water. The fluoride content of the scrubbing water reached 7 g F/l. Maintenance of a pH of more than 10.5 and a salt content of less than 70 g/l helped to prevent any incrustations. This necessitated periodic replenishment of the spent scrubbing liquid by fresh water. The spent liquid was treated with aluminum salts to precipitate the fluoride in the form of kryolith. The dry precipitant contained between 48 and 51% F which could be reused. The sludge collecting in the circulating scrubbing liquid had a settling time of 2 hours. Flocculants did not reduce this settling time. The water content of the sludge was 98%.

1348 APTIC NUMBER 12420

Ishihara, Yoshimi, Chuhei Asakawa, and Hisashi Fukuzawa
REMOVAL OF SULFUR DIOXIDE FROM FLUE GASES BY LIMESTONE, HYDRATED LIME OR DOLOMITE. Electric Power Industry, Tokyo (Japan), Central Research Inst., TR-CH 68001, 8p., March 1969. 5 refs.

The reactivities to sulfur dioxide of limestones, hydrated limes, dolomites, calcined dolomites, and hydrated dolomites from various mining districts in Japan were compared in pilot plant injection experiments. A recycle limestone injection process was also investigated. The reactivity of limestones from the Amami Islands was twice as high as other Japanese limestones. These stones, which are coral reef rock, are a mixture of calcite and aragonite. The reactivity of hydrated limes was slightly higher than that of limestones having an iron oxide content below 0.5%. The reactivities of dolomite, calcined dolomite, and hydrated dolomite were comparable with those of the limestones having iron oxide below 0.5%. The amount of limestone required for injection was found to be substantially reduced by hydrating the recovered sorbent with a stoichiometric amount or 10 to 20% excess water. In this process, the heat of hydration of calcium oxide in the recovered sorbent evaporates the excess water to obtain a dry powder. It is concluded that hydration, by breaking down particle size, exposes fresh surfaces and eliminates the adverse effect of the calcium sulfate shell formed on surface of the sorbent.

1349 APTIC NUMBER 12110

Jacobs, Robert H., Jr.
CONTAMINATION CONTROL IN A HOSPITAL. Preprint, American Assoc. for Contamination Control, Sandusky, Ohio, 7p., 1963. 7 refs.

(Presented at the American Association for Contamination Control, 2nd Annual Convention, Boston, Mass., April 30-May 3, 1963.)

Any environmental approach to the control of wound infection is basically aseptic in nature, i.e., concerned with excluding from the patient those microorganisms which may cause illness or impair the post-operative healing process. Such organisms can enter the surgical suite only when transported there by air, by materials, or by people. Air-handling technology capable of providing the necessary protection is already available; much more difficult is the control of situations where the actual work system of the surgical service must be dealt with. The contamination problems in four systems are reviewed: communications, materials delivery, hospital personnel delivery, and patient delivery. The last provides the greatest break in the aseptic barrier surrounding the surgical suite, and has three basic faults: lack of contamination control, lack of pre-operative patient preparation control, and excessive patient waiting. There is also some evidence that self-infection by the patient is an important factor in wound infection. A proposal is made for the introduction of a surgical center, or complex of nursing and treatment facilities designed to correct these problems.

1350 APTIC NUMBER 16580

Johnstone, H. F. and M. H. Roberts
DEPOSITION OF AEROSOL PARTICLES FROM MOVING GAS STREAMS. Ind. Eng. Chem., 41(11):2417-2423, Nov. 1949. 15 refs.

The theory of deposition of aerosol particles from moving gas streams by impaction and Brownian diffusion was applied to the removal of dust and fumes from industrial gases. The efficiency of deposition on water droplets by centrifugal force across a rotating gas stream was calculated on the basis of Sell's theory of impaction. For a cyclone spray scrubber, the impaction efficiency of individual drops for removing dust particles of various sizes should be a maximum when the drop size is approximately 100 micron. Impaction falls off rapidly for particles below 2 micron in diameter. A comparison of the efficiency of various types of nozzles with different operating characteristics indicates that, for a given mean drop diameter, a nozzle giving a wide distribution of drop sizes should be more efficient for removing small particles by diffusion than a nozzle which gives uniform drops. However, greater efficiency for dust removal and absorption of gases can be obtained by improving the atomization of the liquid over that given by commercial hydraulic nozzles. The absorption of gases with relatively high diffusivities compared with the diffusivities of extremely small aerosol particles takes place at much higher efficiencies than dust removal. The removal of dust and fine fumes by atomization of a liquid injected into a high velocity gas stream takes place at high efficiencies consistent with the high velocity of the gas past the distended surfaces of the drops, films, and filaments. The development of a new Venturi scrubber for collection of dust and absorption of gases during the atomization of a liquid in a high velocity gas stream was described. Large scale installations of this device gave efficiencies of removal of fume from industrial gases between 92 and 99%. The efficiency is a function of the specific drop surface developed per unit volume of gas and depends also on the nature of the fume.

1351 APTIC NUMBER 17798

Jordan, Wenzel von
VENTURI AND RADIAL FLOW WASHERS FOR COOLING AND CLEANING IMPELLENT AND WASTE GASES. (Venturi- und Radialstrom-Waescher zur Kuehlung und Reinigung von Nutz- und Abgasen). Text in German. Stahl Eisen (Duesseldorf), 86(7):399-406, April 7, 1966. 7 refs.

The design, operation, and performance of industrial venturi-type scrubbers with a central jet and radial-flow are reviewed in detail. Venturi scrubbers are widely used as gas coolers and dust removers, as well as for removing gaseous components from gas mixtures. Low space requirements and investment costs are the merits of this system. However, high effectiveness in dust removal is accompanied by a high energy consumption. The modes of operation and applications of venturi scrubbers with a central jet capable of operating with either a small or a large pressure drop, as required, are explained. Performance tests and general operating experience show that the effectiveness of this type of scrubber is not inferior to that of scrubbers with other inlet nozzle arrangements. Experience has also shown that dust accumulations do not exist in high-performance scrubbers of this design; in addition, no preliminary wetting of waste gas is required. One possibility of reducing the energy consumption of high-performance scrubbers is to decrease the volume of gas to be cleaned by appropriate changes of the preceding processing stage so as to prevent the influx of false air or to pre-cool the waste gas. Also, it is desirable to control the scrubber in the case when the gas input to it varies with time in such a manner that the electric current to the waste-gas blower follows the gas input without impairing the effectiveness of the scrubbing process. The radial-flow scrubber is a controllable high-performance scrubber developed for cooling and cleaning of large amounts of gas such as from blast-furnaces. The design and mode of operation of this scrubber combining a cooler section with a washer section traversed by radial jets in a single housing are described.

1352 APTIC NUMBER 17320

Kempner, Stanley K., E. W. Seiler, and Donald H. Bowman
PERFORMANCE OF COMMERCIALLY AVAILABLE EQUIPMENT IN SCRUBBING HYDROGEN CHLORIDE GAS. J. Air Pollution Control Assoc., 20(3): 139-143, March 1970.

Six commercial fume scrubbers were tested for their ability to remove hydrogen chloride gas from plating room exhaust air. The scrubbers, which represent different types of equipment available for this application, were chosen on the basis of their specified ability to remove 90% of the contaminant from a 2500 scfm gas stream consisting of ambient air with 20 mg/cu m of HCl gas. The units were connected to ductwork and piping simulating actual producting conditions. The contaminant was carefully metered into an accurately measured air stream drawn through the scrubber. A continuous sample of the scrubber discharge was recorded by a conductivity meter. The results are presented in a series of curves plotting efficiency vs water rate. Efficiencies of close to 100% were obtained with a vertical packed scrubber and extended surface scrubber. A horizontal packed scrubber and a plate scrubber attained efficiencies of better that 95%. A fan type scrubber was entirely unacceptable and is not recommended for use with a gaseous contaminant. The tests also revealed that optimum efficiencies can be obtained at water rates much lower than those recommended by the manufacturers. This makes it practical to use nonrecirculated water in production scrubbers. Variations in scrubber design and effectiveness of mist eliminators are also discussed. (Author abstract modified)

1353 APTIC NUMBER 11795

Khan, A. A.
HIGH EFFICIENCY AIR CLEANING AND FILTER TESTING. Bhabha Atomic Research Centre, Bombay (India), Waste Treatment Div., B.A.R.C.-347, 21p., 1968.

The use of high-efficiency filters to provide clean and ultra-clean air for certain process atmospheres is reviewed. In the atomic energy industry, high-efficiency filters prevent contamination of atmospheric air by radioisotopes. In hospitals, the filters are used to treat air emanating from infectious wards. In the chemical industry, the filters ensure that beryllium, cadmium, and tellurium dusts are kept within acceptable limits. The are also required by plants processing highly poisonous insecticides and drugs. Because of the manual labor involved in their production and the need for filter testing, the cost of the filters is high. The construction materials required constitute only a small fraction of the total cost. Filters must have a definite guarantee of performance with respect to filtration efficiency, pressure drop, and dust-holding capacity. For this purpose, tests have been devised to ascertain removal efficiency for particles of submicron sizes; pressure drop; capacity; chemical and humidity resistance; and minimum strength requirements. Among the methods of testing filter efficiency, the methylene blue test needs very simple apparatus. Unlike the sodium flame test, it is not suitable for testing filters at high temperatures. The D.O.P. method is exacting and requires fairly expensive apparatus and careful maintenance.

1354 APTIC NUMBER 17518

Kiyoura, Raisaku
ABATEMENT OF AIR AND WATER POLLUTION IN PETROLEUM INDUSTRY. (I). (Sekiyu kojyo ni okeru kogai bojo taisaku (sono I)). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(3):163-170, July 15, 1965.

To plan for abatement of air pollutions in the petroleum industry, the characteristics of crude oil must be considered. Most of the crude oil treated in Japan is from the Middle East and has a high sulfur content. Therefore, somewhat different desulfurization methods than those used in Europe and America are required. As much sulfur as possible should be removed from fuel gas, even though the economic advantage is sometimes inversely proportional to the amount of sulfur collected. With respect to the abatement of air and water pollution, interest is centering on the hydrogenation refining process. Exhaust water, especially that containing oil from petroleum refineries, is a source of water pollution. Seventy percent of the water used in petroleum refineries is discharged, 0.5% of which is polluted. The leakage of crude oil from tankers at the landing docks also pollutes sea water. The Ministry of International Trade and Industry has established criteria for water quality in the petroleum industry. Since most petroleum refineries are located in coastal areas, fish are also contaminated. Modern pollution-control technology is applied at the Negishi Refineries, Nippon Petroleum. The plant has adopted the hydrogen refinery process. Exhaust gas is sufficiently desulfurized. Water circulation processes are employed to reduce the amount of water discharged from the plant, and oily components are removed from the waste water.

1355 APTIC NUMBER 17797

Kocnergin, N. A., I. M. Kaganskiy and E. Z. Shul'ts
APPLICATION OF TOWERS WITH PERFORATED FALL-THROUGH DISCS FOR FREEING GAS OF CARBON DIOXIDE BY A MONOETHANOLAMINE SOLUTION. (Primeneniye kolonn s dyrchatymi proval'nymi tarelkami dlya ochistki gaza ot dvuokisi ugleroda rastvorom monoetanolamina). Text in Russian. Khim. Prom. (Moscow), no. 1:66-69, 1963. 16 refs.

The performance of a scrubber with perforated discs was studied. In operation, the scrubbing liquid entered the column through a spray nozzle at the top, fell through the distributing and four working perforated discs and left it at the bottom; the gas to be scrubbed entered through a diffuser at the bottom and, in rising, interfered with the liquid, producing a layer of foam on top of each working disc. A preliminary series of tests showed that the disc operated stably at wetting rates between 4 and 23 cu m/sq m hr and at all test speeds between 0.73 and 2.02 m/sec. In the main series of tests, the absorption of CO2 from CO2 + N2 mixtures by a 31% MEA solution in the scrubber column was studied at different wetting rates of the MEA solution and different initial CO2-contents and flow speeds of the gas mixture. Samples of the solution and the gas mixture were collected at each flange and the MEA-concentration in the solution and the CO2-content of the solution and the gas mixture were determined. The data were used to calculate a mass-exchange coefficient, K, to characterize the effectiveness of a working disc at the various test conditions. Two plots of lnK vs lnL and vs ln W under specified test conditions are shown. As a result of this type of test-data evaluation, the design formula is proposed: K equals 0.56 L to the 0.83th power W to the 0.75th power, valid for L between 16 and 42 cu m/sq m hr and W between 0.8 and 1.5 m/sec whenever the CO2-content of the solution is between 0 and 0.18 moles of CO2/mole of MEA and the CO2-content of the gas mixture is between 0.04 and 0.26 moles of CO2/mole of N2.

1356 APTIC NUMBER 17791

Konopatov, A. P. and L. D. Strom
OBTAINING ELEMENTAL SULFUR FROM HYDROGEN SULFIDE IN REFINERY GAS. (Polucheniye elementarnoy sery iz serovodoroda neftezavodskikh gazov). Text in Russian. Neftepererab. Neftekhim., no.2:25-29, 1967.

A method is described for obtaining sulfur from the hydrogen sulfide absorbed from refinery gases by ethanolamine. The absorber arrangement reduces H2S content of the gas to 42 mg/cu m, at the same time reaching 18-20 mg/l in the absorbing solution. The hydrogen sulfide is then burned in excess oxygen at 1300 C, producing 68-70% sulfur. The residual H2S is then reacted catalytically with sulfur dioxide; natural bauxite serves as the catalyst. Recovery of 85-86% sulfur has been achieved in practice the production scheme is diagrammed and discussed. This process yields 99.99% sulfur and, at the same time, is effective for air polluton control.

1357 APTIC NUMBER 12133

Korth, Merrill W.
EVALUATION OF A CATALYTIC MUFFLER ON A DIESEL BUS. Preprint, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, Engineering Research and Development Section, 19p., Sept. 1964. 1 ref.

A catalytic muffler, was evaluated on a conventional diesel city transit bus. Based on a limited study, this muffler was reported to be effective in the removal of the typical diesel and acrid types of odors associated with diesel engine exhaust. The tests were performed at three different times during the interval required for the bus to accumulate 20,000 miles in normal operation. The most significant effects of the catalytic muffler were on odor intensity and total hydrocarbon. The typical diesel type of odor was greatly removed even after 20,000 miles of operation. Exhaust total hydrocarbon levels were lower with the catalytic muffler. An average of the results from four power conditions indicated removal of approximately 37% of the total hydrocarbon at the beginning of the test and 18% after 20,000 miles. Odor dilution ratio or smoke levels were not improved. (Author abstract modified)

1358 APTIC NUMBER 11931

Krasovitskii, Yu. V. and V. A. Zhuzhikov
SEPARATION OF DUST FROM STREAM BY FILTRATION AT CONSTANT VELOCITY. (Nekotorye zakonomernosti protsessa razdeleniya pylegazovogo potoka fil'trovaniem pri postoyannoi skorosti). Khim. Prom. (Moscow), no. 2:49-52, 1963. 5 refs. Translated from Russian by Elmar K. Wilip, Argonne National Lab., Ill., 8p., Feb. 1968.

Since conventional methods of purifying gases from finely dispersed dust cannot be applied at temperatures above 600 C the use of laminar filters has been suggested. These filters consist of granules of fire-resistant materials. As indicated by preliminary experiments, separation of dust from a gas stream by such a filter corresponds to filtration with a gradual plugging of the pores of the filtration partition during the purification of liquids where the concentration of solid particles is low. The process was studied only for cases where the pressure difference on both sides of the partition remained constant during filtration. Separation of dust from a gas stream by a laminar filter is carried out at constant flow velocity. In the present study, an equation was derived to describe filtration with a gradual plugging of the pores of the filtering partition at a constant flow velocity. Separation of particles below 1.5 micron from smelter dust corresponds to such filtration. An expression was also obtained for expressing the correlation between filter efficiency and its hydraulic resistance.

1359 APTIC NUMBER 13607

A STUDY OF AIR CLEANING FILTERS IN AN URBAN AREA WITH AIR POLLUTION. (Toshi kogai ni okeru kuki seijo sochi ni knasuru kenkyu.) Text in Japanese. KUKI SEIJO (Clean Air-J. Japan Air Cleaning Assoc.) (Tokyo), 6(5):6-56, Nov. 1968.

Air pollution caused by noxious gases was examined inside and outside a building in the center of Tokyo, where the air is severly polluted. The gases examined in this experiment were SO2, CO, and hydrocarbons. The efficiency of activated carbon filters removing these gases was evaluated. These filters replaced the high-efficiency air filters (NS type 0b) which had previously been used in the heating and cooling system. The SO2 gas and odor inside the building were effectively absorbed by these filters, and sufficient data were obtained to design a ventilation system for these gases. The hydrocarbons and CO were not effectively absorbed; furthermore, the CO concentration inside the building due to smoking was 10 ppm higher than that outside the building. It was therefore recommended that immediate steps be taken to remove CO gas from the building. Dust caused by smoking was analyzed spectrophotometrically and was estimated to be about 10-20% of the total. These data may be used in establishing programs to prevent air pollution.

1360 APTIC NUMBER 17574

Long, W. C.
'NOMEX' NYLON--A NEW HIGH TEMPERATURE MEDIUM FOR GAS FILTRATION. Filtration Separation (Purley), 1965:198, 200, 202, May-June 1965. (Presented at the 55th National Meeting of the American Institute of Chemical Engineers, Houston, Texas, Feb. 1965.)

Nomex is a new synthetic filter medium having high strength, outstanding flux properties, and excellent abrasion resistance. It can be employed in dust filtration equipment up to about 450 F; thus, the fiber is applicable in a temperature range where heretofore glass fabrics were the only economically attractive medium. Filter fabrics of Nomex are produced in four basic forms:

all continuous filament fabrics, usually in twill weaves; all spun yarn fabrics in plain weave and twills; combination fabrics with continuous filament warp and spun filling, usually in twills; and supported, needled felts. Woven fabrics of Nomex are employed primarily in shaker and reverse air type collectors; felts, in pulse jet and reverse-jet equipment. Final choice of an optimum fabric construction for a given installation will depend on factors such as dust loading, release properties, efficiency desired, particle size, etc. Particularly good performance of Nomex filters has been observed in collecting dusts from steel-making operations; dusts from open hearths and electric furnaces are filtered efficiently, even in the presence of fluorides from fluxes or ores. Other successes have been achieved in filtering carbon black, in calcining operations, and in nonferrous metals operations.

1361 APTIC NUMBER 17423

Lowe, J. R.
AN ORIFICE GAS WASHER. American Inst. of Mining, Metallurgical and Petroleum Engineers (AIME), New York, N. Y., Proc. Am. Inst. Mining Met. Petrol. Engrs. Conf. Blast Furnace, Materials 1957, vol. 16:28-30.

By installing orifice washers on furnaces, a steel company reduced the dust content delivered to the mains of its gas-cleaning system from 0.22 to 0.032 grains per cu ft. Each orifice washer assembly consists of a 4-ft 9-in. take-off pipe from the dust catcher to the main outlet and an 8-ft diameter tank which serves as the washer shell. The orifice itself is in the take-off pipe which is located only a few feet from the connection to the dust catcher main. Gases from the tank are passed to the original washer, which now serves as the cooling tower. Necessary water for the gas cleaning is introduced one foot above the orifice through 16 open-end pipes spaced equally around the circumference and perpendicular to the gas flow. Through a faulty design in the outlet gas pipe elevation, much water from the orifice tank is carried mechanically to the bottom of the cooling tower. This will be corrected shortly. In addition to reducing the dust content of the gas, the orifice washer system has brought about a fair-sized reduction in furnace flue-dust rate, in addition to a slight reduction in the coke rate and a commensurate increase in iron production.

1362 APTIC NUMBER 18110

Ludwig, John H.
AIR POLLUTION CONTROL TECHNOLOGY: RESEARCH AND DEVELOPMENT ON NEW AND IMPROVED SYSTEMS. Law and Contemporary Problems, 33(2): 217-226, Spring 1968. 11 refs.

In the area of control of pollution from stationary sources, major research and development is now concentrated on the control of sulfur oxides. In the future there will be expanded programs for other pollutants, especially nitrogen oxides. Major emphasis on control of emissions from motor vehicles is now focused on reduction of carbon monoxide and hydrocarbons. Future efforts will focus on control of nitrogen oxides and particulates and on unconventional vehicles with low pollution potential, such as electric-powered and steam-powered cars. Instruments and techniques are now available for measuring many pollutants, especially inorganic gases, but there is a need for automated, smaller-sized instruments both for stationary sampling stations and for airborne sampling of the atmosphere. There is also a need for remote-type monitors capable of measuring stack emissions from a distance. In the area of meteorology, a number of urban diffusion models and an air pollution potential forecast program are now operational; improved models and quantitative forecasting methods are under development.

1363 APTIC NUMBER 12131

Ludwig, John H.
ENGINEERING RESEARCH AND DEVELOPMENT OF METHODS FOR SULFUR DIOXIDE REMOVAL. Preprint, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, Lab. of Engineering and Physical Sciences, 8p., 1963 (?). 3 refs.

To control sulfur dioxide emissions, the pollutant is either removed directly from the combustion gases, low-sulfur fuels are produced. Processes involving the former method are the Reinluft process, the falling bed, solid-gas contact system (developed by the Bureau of Mines), and the Pauling process. With the Reinluft process, combustion gases at 200 C are passed countercurrent to a massive slow-moving bed of active char; the SO_2 is converted to SO_3 and adsorbed. The char is regenerated by heating in the absence of air to 400 C; SO_2 and CO_2 are driven off in concentrations high enough to permit economical recovery of SO_2 or conversion to H_2SO_4. The cost would be 1.57 dollars per ton of fired oil containing 3.5% sulfur for 95% removal of SO_2 in the exit gases. The process developed by the U. S. Bureau of Mines uses alkalized alumina for the removal of SO_2. The absorbent is regenerated by reducing the sulfur compounds with H_2 and/or CO. The gases from the regeneration can be oxidized to elemental sulfur. A pilot plant is in operation that uses simulated flue gases with subsequent removal of the sulfur as H_2SO_4. The Pauling process immerses active char in water and brings it into contact with the SO_2-laden gas. The SO_2 is converted to SO_3 and leached out as sulfuric acid. Of the processes involving fuel modification, hydrodesulfurization is considered the most practical. Its cost has been estimated to be 5 to 6 dollars per ton of residual processed. Mechanical methods of separation are under investigation, based on differences on grindability and specific gravity.

1364 APTIC NUMBER 17853

Masuda, Senichi
PERFORMANCE OF ELECTROSTATIC PRECIPITATOR AND DESIGN CONSIDERATIONS. (I) PROBABILISTIC DESIGN OF ELECTROSTATIC PRECIPITATOR. (Denkishujinsochi no seino to sekkeijo no kangaekata. (sono I) Denki shujinsochi ni okeru kakuritsuteki sekkeiho). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(3):185-190, July 15, 1965.

Among precipitators, the electrostatic precipitator exhibits superior performance with respect to the following aspects: very good precipitation capability, low operating costs, and easy maintenance. However, it has some drawbacks: the construction costs are very high and it is very difficult to estimate the efficiency before construction. Because of various uncertainties and unexpected phenomena it is extremely difficult to design an electrostatic precipitator for optimum performance. Sixty years have passed since the technique of electrostatic precipitation was discovered, and most of the elementary phenomena associated with it have been thoroughly solved by inventors, technical experts, and investigators. In spite of this, the final way of designing this precipitator still has not been established. The paper emphasizes the probabilistic nature of the design, and compares a new design with the conventional one, using a series of mathematical formulas.

1365 APTIC NUMBER 17538

Ministry of International Trade and Industry (Japan)
ON THE LOW-SULFUR POLICY. (Teiioka taisaku ni tsuite). Text in Japanese. Kankocho Kogaisenmon Shiryo (Public Nuisance Gaz.), 4(6):2-13, Nov. 1969.

The basic policy of the Ministry of International Trade and Industry toward sulfur reduction is reviewed, as are approved control methods. The Ministry is concerned with techniques for meeting SO2 emission standards, reduction of the sulfur content of fuel, and adequate supplies of low-cost and stabilized fuel. The approaches considered include the following: the import of low-sulfur crude petroleum; desulfurization of heavy oil; removal of SO2 from waste gases; the import of low-sulfur heavy oil; crude 'burning' of unrefined petroleum; the import of natural gas; and the practical use of atomic power. These countermeasures are discussed with respect to cost, resources, technical development, and plant redesign. The present status of desulfurization of flue gas is described, together with future problems. The paper concludes with a summary of the government's objectives for 1970.

1366 APTIC NUMBER 17461

Mori, Kenji
A PURIFIER OF IMPURITIES IN A CHIMNEY. (Entotsu no fujunbutsu joka sochi). Text in Japanese. (Assignee not given.) Japanese Pat. Sho 44-23866. 2p., Oct. 9, 1969. (Appl. May 1, 1963, claims not given).

Equipment is described which collects stack impurities such as soot, absorbs them in bubbles of sprayed washing liquid, and settles them in a bath. The purifier is installed at the flue between the stack and the boiler room. It consists of a fan for gathering the impurities contained in the combustion gas, nozzles for sprinkling the liquid, and the bath for receiving the impurities and absorbent. The fan is in the form of a circular cone of thermostable wire gauze and is fitted at the vertical place of the flue to revolve with a motor. The thermostable wire gauze has enough sizes of mesh to gather all sizes of impurities. Because the revolving fan generates a difference in flow speed in the flue, the combustion gas is smoothly exhausted.

1367 APTIC NUMBER 17570

Munro, A. J. E. and E. G. Masdin
A STUDY OF A METHOD FOR DESULPHURISING FUEL GASES. Brit. Chem. Eng., 12(3):369-373, March 1967. 7 refs.

The catalytic conversion of hydrogen sulfide in low concentrations to elemental sulfur was studied after the gasification of sulfur-bearing fuels. The conversion is as high as 93% with a molecular sieve catalyst and 88% with activated alumina when using a synthetic mixture of clean gases containing 0.5%v H2S and 0.25%v SO2 at a space velocity of 70 volumes H2S per volume of catalyst-hour. With either catalyst in a static bed, a temperature of 250 C is optimum for prolonged operation, giving the highest conversion without a noticeable decrease in catalyst activity with time. The theoretical procedure for calculating conversions is reviewed and proves very satisfactory; practical conversions are accurately predicted under conditions where the cayalyst has not been deactivated. As the space velocity is increased above 100, the conversion falls with either catalyst, although the effect is more pronounced with activated alumina. The presence of water vapor in the gas stream reduces the conversion appreciably; here again the molecular sieve catalyst proved more effective. The presence of hydrogen has no effect on the conversion of low levels of H2S with either catalyst, but a high concentration of carbon monoxide does reduce the conversion significantly. For the process to be effective in treating actual gasification products, it is essential that the chemical reactions in the gasifier reach equilibrium so that the bulk of the sulfur in the fuel is converted to H2S; fluctuations in the concentrations of various sulfur compounds that will otherwise be present make the control of the catalytic process very difficult. (Author conclusions modified)

1368 APTIC NUMBER 18113

Myers, P. S. and O. A. Uyehara
MANY POSSIBILITIES EXIST FOR ELIMINATING MAJOR POLLUTANTS FROM EXHAUST GAS. S.A.E. (Soc. Automot. Engrs.) J., 77(3):34-36, March 1969.

Solution of the exhaust emission problem depends on the elimination of partially oxidized components of the fuel. Oxides of nitrogen and carbon monoxide are formed primarily in the bulk gas; hydrocarbons are formed in the quench area. Addding an inert gas, using a lean mixture, or using a rich mixture are some of the ideas suggested for eliminating these pollutants. The interrelationships of these pollutants must be considered in any plan to eliminate them from exhaust gas.

1369 APTIC NUMBER 11830

National Asphalt Pavement Assoc., Riverdale, Del.
GUIDE FOR AIR POLLUTION CONTROL OF HOT MIX ASPHALT PLANTS.
Information Series no. 17, 26p., 1966 (?). 11 refs.

The nature of pollutants produced by hot mix asphalt plant processes, measures for their control, and control objectives are reviewed, together with sampling procedures for measuring the quantity of dust and other solid particles emanating from exhaust stacks. Pollutants emitted by a plant are gasses, vapors, and particulates. The particles include fumes, mist, fog, smokes, and dust, the latter forming the bulk of pollutant emissions. The principle source of this dust is the rotary dryer. Pollution control equipment for asphalt plants falls into two categories: dry collectors and wet collectors. The primary collector which receives the main dust stream is almost always a dry collector, particularly a cyclone. Where emission standards are most stringent, it is necessary to use one or more secondary collectors, either wet or dry. Wet collectors are highly effective as final cleaning units; a well-designed combination of dry primary and wet secondary collectors can remove than 99% of the dust in the exhaust stream. The majority of wet collectors are impingement or centrifugal scrubbers. In addition to the rotary dryer, hot vibratory screens, elevators, and transfer points can release dust in quantities amounting to 10% of total emissions. To trap and convey this dust to collectors, hoods, and ducts are necessary. Compliance by plant with visual opacity standards for stack exhaust is usually checked with the Ringelmann Chart; the quantity of dust and other solid particles are checked by isokinetic sampling.

1370 APTIC NUMBER 17717

Neumann, Bernhard, Heinz Panzner, and Erich Goebel
THE EFFECT OF VARIOUS CATALYSTS ON THE SO2 CONTACT PROCESS.
(Die Wirksamkeit verschiedener Kontaktsubstanzen beim Schwefelsaeure-Kontaktprozess. I). . Text in German. Z. Elektrochem 34(10):696-704, 1928. 14 refs.

The effects of platinum, silver vanadate, vanadic acid, copper vanadate, containing vanadic acid and silver and tungstic acid catalysts on the sulfur dioxide contact process were experimentally investigated. The catalysts were placed between two glass wool layers in a glass tube 70 cm long and 2 cm wide. A mixture of air and 7% SO_2 was used. With platinum as catalyst, the maximum activity was observed at 425 C where 99.5 and 99.7% of the SO_2 were converted. The results agreed with those obtained by Knietsch. This process was mainly used for calibrating the equipment. With silver vanadate, the maximum conversion was observed at 450 C with 97% converted. The gas speed was 150 cu cm/min. With increasing gas speed, the efficiency of the catalyst decreased. With vanadic acid, almost no reactions were observed below 400 C. At a gas speed of 150 cu cm/min, the maximum was observed at 512 C with 90% of the SO_2 converted. At a gas speed of 300 cu cm/min, the maximum was reached at 550 C with 79.5% converted. With copper vanadate containing vanadic acid, only slightly higher outputs were gained than with pure vanadic acid. The catalytic effect of silver was found to be very low. The catalytic activity of tungstic acid was much lower than that of pure vanadic acid.

1371 APTIC NUMBER 17559

Nichlin, F. and E. Brunner
HOW STRETFORD PROCESS IS WORKING. Hydrocarbon Process Petrol. Refiner, 40(12):141-146, Dec. 1961. 18 refs.

Results of plant-scale tests are reviewed for the Stretford Process, a method for continuous purification of gas or liquid mixtures containing hydrogen sulfide, which uses an aqueous alkaline solution of sodium salts of anthraquinone disulfonic acids. In the regeneration step, sulfur is precipitated. the plant operation is described, and factors affecting the level of H_2S removal, operating costs, and side reactions are discussed. Operating costs are estimated at 21 cents per stu, most of which is for labor and power; this cost can complete oconomically with other liquid or oxide purifiers, and does not take into account credit from the sale of by-product sulfur. Although intended originally for the removal of H_2S from the coal gas, the method appears to have application to purification of refinery gases, effluent air streams as in the viscose and transparent paper industries, gases rich in carbon dioxide, of crude benzoles and petroleum products containing H_2S. Improvement of the method by the use of sodium vanadate is under development. This additive has the effect of speeding the reaction and improving the weight of sulfur produced from a given volume of washing medium.

1372 APTIC NUMBER 17517

Nishida, Konosuke
A COMPARISON ON SOME PRACTICAL CONTROL TECHNIQUES FOR AUTO EXHAUST. (I). (Jitsuyoteki jidosha haiki gasu boshiho no hikaku. (I)). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 6(3):187-194, March 15, 1970.

Control of exhausts from used cars is an important factor in reducing air pollution in Japanese cities. Effective control is obtained with an auxiliary air pump, improved ignition apparatus, or idling regulators. Results of a recent study of these devices are reported. The auxiliary air pump which is installed at the intake manifold, is a vacuum-control apparatus that operates in response to increases and decreases of the vacuum of a cylinder. This installation not only reduces the load of engine absorption but also improves air combustion. Changes in concentrations of waste gas, engine speed and the amount of fuel consumed were measured on 1961 and 1964 model cars after idling for about half an hour at a fixed engine temperature. Carbon dioxide density was 4.84% with the apparatus and 9.43% without it. The removal rate of CO reached 72.5%. An improved fuel efficiency resulted. The improved ignition apparatus uses a gap sparking. The device reduces fuel consumption by about 19.8%. At a fixed speed (10-80 km/h), improved fuel efficiency reached 21.2%. The result is a change in concentrations of inorganic gas components. Despite the ability of these devices to reduce exhaust emissions, the prevention of air pollution will require even more effective systems.

1373 APTIC NUMBER 12238

North American Rockwell Corp., Canoga Park, Calif., Atomics International Div.
DEVELOPMENT OF A MOLTEN CARBONATE PROCESS FOR REMOVAL OF SULFUR DIOXIDE FROM POWER PLANT STACK GASES. (SUMMARY REPORT). Contract PH 86-67-128, AI-68-108, 155p., 1968. 8 refs.
CFSTI: PB 179908

A Progress report is presented of a method being developed for sulfur dioxide removal from power plant stack gases. The sulfur oxides are absorbed in a molten mixture of lithium, sodium, and potassium carbonates, reacting with the carbonates to form sulfites and sulfates, which remain dissolved in excess carbonate. The molten carbonate-sulfite-sulfate salt mixture is then regenerated chemically, converting the sulfite and sulfate back to carbonate and the sulfur to hydrogen sulfide. The carbonate is then recirculated to the scrubber to continue the process. Testing shows the carbonate melt to be an excellent absorbent under realistic conditions, with a very fast reaction rate. The main problem in the absorption process is one of bringing the sulfur oxides into good contact with the melt. Recent reduction studies are emphasizing catalysis to increase the rate of the reduction reaction. Regeneration refinement is underway to eliminate sulfur tie-up and foaming problems from reduction catalysts. Corrosion studies of suitable metals and alloys, and contactor development, are described.

1374 APTIC NUMBER 17849

Ozerskii, Yu. G., G. A. Markus, and V. I. Oratovskii
RECOVERY OF PHENOLS AND HYDROGEN SULPHIDE FROM WASTES DISCHARGED TO ATMOSPHERE. Coke Chem. (USSR) (English translation from Russian of: Koks i Khim.), vol. 6:41-44, 1969. 4 refs.

Given lengthy contact times between an alkaline solution and a mixture of air and gases containing phenols and hydrogen sulfide, the residual contents in the gaseous phase will depend on the dynamic gas-liquid equilibrium conditions. The latter are dependent on a number of factors, including the alkali solution concentration, the nature of the phenols present, the cumulative phenols content of the solution, and the solution temperature. Liquid-vapor equilibrium conditions are investigated at 30-60 C for colorimetric determination by the para-nitroaniline method. Phenol content of the gas-air mixture increases by a factor of 3-5 as the phenolate solution temperature is raised; as the phenols build up in the alkali solution, the gas-air mixture retains a higher residual phenol content. The equilibrium hydrogen sulfide concentration of the gas-air mixture increases from 1 to 5 mg per sq m as the temperature is raised from 30 to 60 C, but the equilibrium H2S concentration in the scrubbed discharge is negligibly small, since the sulfides in the circulating solution are oxidised to form sodium sulfite and thiosulfate.

1375 APTIC NUMBER 17736

Pasternak, Rudolf
NEW METHODS OF H2S-AND CO2-REMOVAL FROM GASES. (Neue Verfahren der H2S-und CO2-Entfernung aus Gasen). Text in German. Gas Wasserfach (Munich), 103(17):417-418, April, 1962. 6 refs.

Three methods of hydrogen sulfide and carbon dioxide removed from the waste gases are reviewed with respect to their descriptions. The 'Shell ADIP method' is a cyclic scrubbing process using the 'ADIP' solution as the liquid phase, in which H2S contained in the gas phase is reversibly absorbed and can be converted to H2SO4 by a wet catalysis or to elementary 99.97% pure sulfur in a Claus furnace. The ADIP solution also absorbs COS and CO2 from the gas phase and can contain a large ratio of H2S before loosing its absorptive capacity. Either subsequent processing of H2S yields enough free heating steam for regeneration of the loaded ADIP solution. The 'Stretford method' is a successor of the 'THYLOX' or the 'PEROX' method in which H2S is converted by the aerated [illegible] solution (a solution of the Na salts of anthraquinone dis[illegible]c acids) activated by additions of vanadium or iron compounds to elementary 99% pure sulfur in a single stage. The scrubber solution absorbs hydrocarbons from the gas phase which may lower the sulfur yield. The 'Fluor-solvent method' requires that the gas to be cleaned be under a high pressure. It is a cyclic process in which the 'Fluor' solution absorbs H2S nearly completely, and CO2 up to about 90 to 95%, from the gas phase and releases them during regeneration which is effected by decompression of the loaded Fluor solution. This method possesses many operational and economic advantages. One of its short comings is that the absorbed substances are recovered substantially in the same ratio in which they were present in the Fluor solution.

1376 APTIC NUMBER 11818

Perasso, David, Mona Sarfaty, D. Ren Brown, Carl Goodwin, and Andrew Joseph
A PROPOSAL FOR THE INSPECTION AND MAINTENANCE OF AUTOMOBILE EMISSION CONTROL SYSTEMS. In: Air Pollution Project: An Educational Experiment in Self-Directed Research, Summer 1968. Associated Students of the California Inst. of Tech., Pasadena, p. 281-317, 1968. 37 refs.

Emissions from motor vehicles are of such magnitude that the State of California and the federal government have enacted legislation requiring new motor vehicles to meet certain emission standards. By and large, new motor vehicles have met these standards. However, as the engine is used, the effectiveness of its control system deteriorates and the amount of hydrocarbons, carbon monoxide, and nitrogen oxides emitted increases. Previous attempts to reverse this trend or to tune up older cars for low emissions have failed because not enought diagnostic information was gathered. Yet, a 1 to 1-1/2 min test consisting of measuring the emissions at several modes of engine operation, coupled with simple under the hood examination, can provide adequate diagnostic information about an vehicular emission problems. If subsequent repairs were detailed by the inspector, an emissions reduction would be virtually guaranteed. Such a system could also be used on preemission controlled cars. The total reduction of contaminants would be approximately 19% for HC and CO and 5-10% for NOx. The cost of inspection would be approximately $3.00. In addition to reducing air pollution, the system should reduce the cost of car maintenance by providing accurate diagnosis of many potentially expensive engine problems. (Author abstract modified)

1377 APTIC NUMBER 12253

Perry, Harry and J. H. Field
COAL AND SULFUR DIOXIDE POLLUTION. Preprint, American Society of Medical Engineers, New York, 9p., 1967. 19 refs. (Presented at the American Society of Mechanical Engineers, Winter Annual Meeting and Energy Systems Exposition, Pittsburgh, Pa., Nov. 12-17, 1967.)

Presently about 143 million tons of pollutants per year are discharged into the air over the United States. Carbon monoxide represents about one-half of all pollutants, sulfur oxides are the next largest pollutant (15% of the total emission) followed by hydrocarbons and nitrogen oxides. To reduce sulfur oxide in the atmosphere, the following measures can be taken: use of low-sulfur fuels; desulfurization of fuel prior to use; selective mining of coal; injection of desulfurizing additives into the boiler; removal of sulfur oxides from stack gases; dispersion and dilution of the sulfur oxides through high stacks; mine mouth generation of power; and use of nuclear energy. Removal of sulfur oxide during in-process combustion has the advantage of being applicable to many existing plants where stack removal processes would be physically impossible to install. Reduction of the sulfur content of medium and high-sulfur coals is particularly beneficial for existing power plants and for all small installations. Froth floatation is less suited for this purpose, since pyrite and coal have similar surface properties. As a consequence, little sulfur reduction is achieved. Oxidation of pyrite to sulfur is probibility expensive. Removal of SO2 from stack gases offers hope of the greatest reduction of this pollutant. The Reinluft process, Monsanto process, and the alkalized alumina process are briefly outlined. Capital investment of these processes ranges from 10 to 20 dollars per installed kilowatt with operating cost of about 0.75 to 1.50 dollars per ton of fuel burned after allowing credit for by-products. Mention of the Japanese Kiyoura process and the DAP-Mn process is also made.

1378 APTIC NUMBER 17448

Persson, A. R. and J. O. Naucler
SEPARATION OF GASES IN A MIXTURE. (Separering iv gaser i blandning). Text in Swedish. (Assignee not given.) Swedish Pat. 124,600. 3p., April 12, 1949. (Appl. Feb. 10, 1949, 6 claims).

An economically profitable absorption was obtained by circulating solutions containing a foaming agent in order to recover carbon dioxide, sulfur dioxide, or methane. It uses a liquid absorber which circulates past an absorption contact point and an expulsion contact point. The liquid absorber is mixed with potassium amyl sulfate or some other foaming agent, which with a continuous bubbling of gas under normal operating conditions will be distributed evenly throughout the liquid absorber as it circulates through the apparatus. The gas mixture is conducted through several screens, arranged in series inside the absorber and over which the liquid absorber flows to the expeller, where it flows over one or more suitable screens connected in series, through which a number of gases or vapors are passed. The gas and/or liquid absorber is cooled in front of and/or during the absorbing stage, preferably to 60-65 C, or as even lower temperature. Gases admitted to the expeller are at a temperatue above 60 C, with 80-100 deg recommended. The liquid absorber from the absorption stage is warmed by the liquid absorber as it comes from the expeller. The quantity of foaming agent and its distribution is such that the bubbles are about 3-5 mm in size.

1379 APTIC NUMBER 12346

Pircon, L. J. and O. H. M. Wilder
ODOR CONTROL BY CATALYTIC OXIDATION OF RENDERED EXHAUST VAPORS. Bull. Am. Meat Inst. Found., no. 37, 22p., April 1958. 2 refs.

The feasibility and effectiveness of the catalytic combustion technique in eliminating odors from the rendering of animal tissue was studied. An electric heat source was used for convenience, although a gas or oil burner could also be used; the catalyst was of platinum-palladium. The apparatus and performance tests are described in detail. The temperature of the vapor entering the catalyst reached 700-800 F; the maximum flow rate was 1210 lb/hr/sq ft of transverse catalyst area for a normal packing depth of 3-3/4 in., although there was no indication that higher velocities could not be handled adequately. All offensive odors were eliminated from the cooker exhaust by passing through the catalyst; this was true all through the cooking and rendering cycle, and was accomplished at a temperature considerably below the incineration temperature necessary if a catalyst had not been used. Considerable cost savings are foreseen with the use of this method.

1380 APTIC NUMBER 17531

Porteous, Andrew and Graham D. Wallis
A CONTRIBUTION TOWARDS THE REDUCTION OF ICE FOG CAUSED BY HUMID STACK GASES AT ALASKAN POWER STATIONS. Atmos. Environ., vol. 4:21-33, 1970. 10 refs.

The intermittent occurrence of ice fog formed by the freezing of clouds at super-cooled water at 20-40 C at U. S. Air Bases in Fairbanks, Alaska causes severe visibility problems. At these temperatures, water vapor nucleates and freezes on grit particles to form minute ice crystals that have no appreciable settling velocity. The principle source of water vapor emissions at the bases are power station stack gases. Dehumidification of the flue gases was experimentally studied in a counter-current scrubbing apparatus to obtain optimum droplet size for both moisture and grit removal in a spray tower. In counter-current scrubbing, sprays of cold water are directed into hot gas flows, with the water droplets in effect forming an efficient counter-current heat exchanger. Heat and mass transfer proceed simultaneously; the processes are rate controlled. Based on the experimental results, optimum droplet size for accomplishing both grid and moisture removal was determined to be about 1000 micrometer diameter. This permits initial flue gas velocities of 2.1 reciprocal msec which are low enough to eliminate the risk of particle entrainment.

1381 APTIC NUMBER 17429

Postnikov, V. F. and A. A. Astasheva
ABSORPTION OF SULFUR DIOXIDE BY XYLIDINE. (Absorbtsiya sernistogo gaza ksilidinom). Text in Russian. Khim. Prom. (Moscow), 17(3):14-19, 1940. 13 refs.

The solubility of sulfur dioxide in water solutions of xylidine was found to range from 28-40% and SO2 concentrations of 112 g/l are possible with absorption from gases containing 0.5-0.6% SO2; the absorption rate was quite high. Water-to-xylidine ratios of 2:1 and 1:1 are practical for gases with an SO2 content of at least 0.4%, absorption taking place at 20C; desorption takes place at about 100 C. Xylidine solutions are recommended for use in place of water removing SO2 from stack gases when the SO2 concentrations is low.

1382 APTIC NUMBER 17554

SYMPOSIUM ON 'SULFUR EMISSION CONTROL'. ('Teiiou taisaku ni tsuite'-zadankai). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 6(3):148-165, March 25, 1970.

Six major subjects concerned with the control of sulfur emissions from heavy oil combustion are discussed. The administrative approach to air pollution control as a whole is given direction by establishment of ambient air standards, the framework of which is provided by emission standards. Emission standards are not intended to be an index of the present or future state of air pollution in Japan, since they are linked to individual pollutant sources. In response to increased sulfur emissions from oil combustion, the General Energy Research Committee has presented four types of directions for sulfur-emission control; efforts to achieve a balance between ambient standards and emission standards; efforts to increase imports of low sulfur content oil; efforts to promote sulfur control techniques; and an attempt to reduce the sulfur content of smoke. A research project on sulfur emission control has reached the pilot plant stage and is expected to provide a successful technique for solving the problem of cost equilibration. The relation between supply and demand on the price of low-sulfur heavy oil is described. Sale of by-products of oil combustion processes can offset the costs involved in sulfur removal schemes. Domestic and foreign markets for pitch are under investigation. The current trend toward increasing natural gas demand is noted; natural gas resources exceed those of heavy oil.

1383 APTIC NUMBER 17476

Schlegel, H.
USE OF NOVEL FILTER-MEDIA IN THE DUST COLLECTION TECHNIQUE. (Einsatz von neuen Filtermedien in der Entstaubungstechnik). Text in German. Aufbereitungs-Technik, 10(9):505-508, Sept. 1969.

The development of needle-felt for bag and envelope type filters widened their range of application. Presently, needle-felts of polyacrylic nitrile are primarily used as filters for drying plants, where the temperatures reach 140 C. Polyester felts are used for dry gases with temperatures up to 150 C. Polyamide felts are available for temperatures between 150 and 220 C. The latter type has little resistance to acids. The efficiency of needle-felt filters matches that of wool filters. Their mechanical strength is lower, however, which is a disadvantage for cleaning purposes. The filter resistance is lower, generally by 20 to 40 mm water, as compared to cloth filters. Needle felts are formed in needle introducing machines. Fabrics used as filter media are usually processed several times in these machines. An illustration and brief description of such machines is given.

1384 APTIC NUMBER 12417

Seki, Shingo, Kiyoshi Kasahara, Takeo Kuriyama, and Makoto Kawasumi
STUDY ON THE UTILIZATION OF CINDER ASH FOR CONCRETE MANUFACTURING. Electric Power Industry, Tokyo (Japan), Central Research Inst., TR-C:68001, 26p., Feb. 1969. 9 refs.

In Japan, coal-burning power plants discharge about 600,000 tons of fly ash and about 3,400,000 tons of cinder ash annually. Unlike fly ash, cinder ash is a comparatively coarse ash that has not been widely utilized in cement manufacturing. Stream-curing and water-curing processes for its utilization are detailed. The methods make possible the production of cement paste, mortar, and lightweight aerated concrete of high quality from cinder ash, lime, and quenched blast furnace slag without the addition of portland cement. The maximum compressive strength of the mortar is 550 kg/sq cm after steam curing at 90 C for the day and 680 kg/sq cm after water curing at 20 C for 91 days.

1385 APTIC NUMBER 17460

Shimizu, Yoshikazu, Keiichi Inoue, Hiroyuki Nishikata, Yutaka Koenuma, Yasurhiro Takemura, Reiji Aizawa, Satoru Kobayashi, Kozo Egi, Keishin Matsumoto, and Noriaki Wakao
KINETICS OF CATALYTIC HYDRODESULFURIZATION OF FUEL OIL IN TRICKLING PACKED BED REACTOR. (Kaneki shokubai jutenso niyoru juyu no suisoka datsuryu hanno no kaiseki). Text in Japanese. Kagaku Kogaku (Chem. Eng.), 34(2):193-197, Feb. 5, 1970. 6 refs.

Kinetic equations were derived for catalytic dehydrodesulfurization of fuel oil in a fluidized packed bed reacter which taken into account the processes of hydrogen dissolution into oil, diffusion in pores, and intrinsic chemical reaction. Experiments at 370-420 C and at hydrogen pressures between 51-131 atm indicated that the desulfurization reaction of the Khafji residual oil was second order with respect to the sulfur concentration in oil. The apparatus used was a stainless-steel tube of 8 mm inner diameter and 3 m length, packed with catalysts (P-36 or R26-2) made of Co, Mo, and silica alumina. During the initial 20-50 hours a degradation of the catalysts was observed. The measurements were taken after the transient period. The tube was heated in an electric furnace. The sulfur content was analyzed by the bomb method. The effect of total pressure on reaction rate was also examined, and a linear relationship was found between the two variables. The activation energy was 28 kcal/mol. If the porous diffusion was rate controlling, the apparent activation energy should have been much smaller than this value. Thus, the intrinsic chemical reaction was concluded to be rate controlling. The results obtained are useful in classifying the conflicting theories on the process, thus giving a starting point for the scaling up of the process.

1386 APTIC NUMBER 12310

Squires, Arthur M. and Robert Pfeffer
PANEL BED FILTERS FOR SIMULTANEOUS REMOVAL OF FLY ASH AND SULFUR DIOXIDE: I. INTRODUCTION. Preprint, Air Pollution Control Association, New York City, 33p., 1969. 32 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 62nd, New York, June 22-26, 1969, Paper 69-202.)

Explanatory trials of three panel bed filters (using 16-30 mesh sand and operating at a face velocity around 12 ft/min) indicated a good probability that such a device can achieve 99% filtration efficiency on power-station fly ash, while simultaneously removing sulfur dioxide. A 'puffback' technique was used to remove fly ash and a portion of the sand from the gas-entry face of a panel. Of the three test units used, the first had 2 sides of plexiglass and 2 of metal, while the second was constructed entirely out of plexiglass. The third was also plexiglass, but with brass louvers. Filter sand did not have to be rendered free of ultra-fine particles when being cleaned for reuse. The louvers of the third test unit compel the smoke to flow upward through special gas-treating spaces. This unit also used 8-12 mesh sand as a 'sealing solid' in addition to the 16-30 sand used as treating solid. Retaining screens should not be used at the clean face of the panel bed filter. The reactive solid used for the removal of SO2 should be regenerated before returning it to the supply bin. Based upon the experimental results, a commercial design would appear to provide a gas-treating capacity per unit ground area on the order of four times greater than an electrostatic precipitator of comparable efficiency. A program to develop a practicable panel bed device for simultaneous removal of fly ash and SO2 is recommended. (Author abstract modified)

1387 APTIC NUMBER 17293

Terabe, Mototsuju
BAD SMELLS AND COUNTERMEASURES FOR THE PUBLIS NUISANCE. (Akushuh to kohgai taisaku). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 5(12):696-702, Dec. 25, 1969. 17 refs.

Most malodorous substances are organic substances containing nitrogen or sulfur, such as amines and mercaptans. Other malodorous substances containing no nitrogen and sulfur are phenols, cresols, butyric acid, and valeric acid. Industrial plants which possibly emit malodorous substances process paints, metals, plastics, oils, fats, petroleum refinery, and gum. Unpleasant odors are one of the most complex public nuisances. Odors are generated by many kinds and small quantities of substances, and the only measuring apparatus is man's nose. Katz classified the intensities of smells into five classes: zero is no odor; one, barely perceptable; two, faint; three, easily noticed; four, strong; and five very strong. The relationship of this scale to ppm with several sulfur compounds was studied. The intensity of smell did not directly correspond to the density. When the density became ten times, the intensity becomes about double. The degree of odor, odor unit, odor concentration and odor emission rate were explained. G. Leonardos measured odor thresholds of 57 chemicals. Deodorization methods were classified into absorption, adsorption, chemical oxidation, combustion, and neutralization. Deodorization methods having practical utility were explained. The adsorption method using activated coal is useful for alchols, acetic acid, butyric acid, caprylic acid, benzene, and mercaptans. Adsorption efficiencies of activated coal were tabulated for 97 substances. Removal of hydrogen sulfide was studied by many methods. The Takahax wet method, absorption by naphtoquinone sulfonic acid was noteworthy. Organic substances are removed efficiently by direct gas flame incineration.

1388 APTIC NUMBER 16729

Thoen, G. N. and G. G. DeHaas
RECOVERY FURNACES OPERATED WITH CONTINUOUS SULPHUR ANALYZER. Paper Trade J., 153(19):61-62, May 12, 1969.

A continuous analyzer used for measurement of SO2 and reduced sulfur compounds was tested on a 350 tn/d black liquor furnace. The system had a sensitivity of better than 5 ppb of H2S based on 700 F flue gas analysis. It was found that steam and reduction of smelt were a first order function of reduced sulfur compounds in the flue gases. Some examples of adjustments made in the system are given.

1389 APTIC NUMBER 17539

Umeda, Hiroyuki
POINTS AT ISSUE IN THE DESULFURIZATION OF HEAVY OILS. (Juyu teiioka no mondaiton). Text in Japanese. Nenryo Oyobi Nensyo (Fuel and Combustion), 36(12):1179-1188, Dec. 1, 1969. 8 refs.

Because the desulfurization of heavy oil is an important aspect of air-pollution abatement, plants for the hydrodesulfurization of distillate oils (naphtha, kerosene, light oil) are often considered indispensible. In the United States, the hydrodecomposition method is finding rapid acceptance. The demand for high-quality gasoline promoted the development of the high-pressure, steel forming, and the partial-oxidation method for the production of high-purity hydrogen. These techniques are applied in both indirect and direct desulfurization processes, many of which have been introduced in Japan. Flow charts are presented to illustrate direct and indirect processes as used alone or in combination. Desulfurization by reduced pressure distillation is a typical indirect desulfurization method. A straight asphalt is obtained at the bottom of the reduced pressure flash tower; its sulfur content is high. If this asphalt can be sold at a profitable price, it will be a large gain to the desulfurization of heavy oil in the oil factory. Also included are a direct residual-oil desulfurization method and an indirect method which uses desulfurization equipment on reduced pressure residual oil. It is concluded that the general trend is toward the direct desulfurization, although an optimum combination of the direct and indirect methods should be considered.

1390 APTIC NUMBER 17454

Voicu, V., V. Popescu, Gh. Ardar, O. Popescu, and I. Dosa
TOWARD INCREASED EFFICIENCY OF CYCLONE SEPARATORS IN TRAPPING INDUSTRIAL DUST PARTICLES. (Pentru marirea randamentului cicloanelor in vederea retinerii prafului industrial). Text in Romanian. Ind. Lepnului, 19(12):501-508, Dec. 1968.

A series of studies was conducted from 1966 to 1967 on the functional parameters of the major types of cyclones, to establish criteria for choosing the types to be applied in industry. The cyclones tested were classified according to type and size: two types of dust cyclones (ISPF and ICSPM, with 400 and 600 mm diameters); and one type of cyclone for sawdust (ISPF, with diameters of 400, 600, 1000, and 2650 mm). The experiments, which pointed out the importance of the shape of the cyclone and the dimensions of its intake opening, were conducted in the context of a woodworking shop. A large number of diagrams and tables are given, showing the structure of the various cyclone types, experimental layouts used, technical and operating characteristics of the cyclones, efficiency graphs, and the operating costs as a function of capacity.

1391 APTIC NUMBER 17495

Wade, Bryan
THE MODERN APPROACH TO DUST EXTRACTION IN FULLY AUTOMATIC FOUNDRIES. Filtration Separation (Purley), vol., 7:183-191, March-April 1970. (Presented at the Filtration Society's Conference on Choosing the Right Equipment for Dust Control and Air Cleaning, Dust Control and Air Cleaning Exhibition, London, Sept. 23-25.)

High efficiency cyclone dust extraction in a modern foundry can be expected to cost 150-175 English pounds per 1000 feet/min, using a sand plant installation. Wet collectors will require 275 pounds per thousand when equipped with drag link conveyor and 300 pounds per thousand for the drain-off type. Design criteria are discussed for the application of extraction to knock-out and shake-out areas, rotary screens, belt conveyor transfer points, bucket elevator housings, laboratory screens, sand cooling towers, and storage hoppers. Air volumes are specified for each application, assuming that the plant is to be as fully automated as possible. A totally enclosed shake out hood requires a general air rate of 300 cfm/per square foot of grid area. Each exhaust connection must be made on the assumption of an air volume of 450 cfm per foot width of belt. The wet collector has for some years been the only suitable type of equipment; the self-induced spray type wet collector is the most popular because of its high collection efficiency, few moving parts, constant collector pressure drop, the fact that collected dust can be disposed of in the form of de-watered slurry, simplified maintenance, minimum internal cleaning, minimum water requirements (1/2 to 1 gallon per hour per 1000 cfm), and its indifference to air moisture.

1392 APTIC NUMBER 18089

Waid, Donald E.
INCINERATION OF ORGANIC MATERIALS BY DIRECT GAS FLAME FOR AIR POLLUTION CONTROL. Am. Ind. Hyg. Assoc. J., 30(3):291-297, May-June 1969.

This paper gives a summary of industries where direct gas flame incineration is applicable for air pollution control and traces the nationwide development and recent applications of this device in Los Angeles County, San Francisco Bay area, and Chicago. Test data are given which include information on heat recovery methods, performance, and design criteria. An approach to solving a typical air pollution control problem by the use of gas flame incineration is presented. (Author's Abstract)

1393 APTIC NUMBER 17465

'AIR POLLUTION CONTROL' MEETING AND EXHBITION. (Kongress und Ausstellung 'Reinhaltung der Luft'). Text in German. Wasser Luft Betrieb, 14(1):30-31, 1970.

The meeting and exhibition 'Air Pollution Control' held in Duesseldorf October 13-17, 1969 introduced no fundamentally new control equipment or method. Few centrifugal separators were on display. Noteworthy among the cyclones was one with two gas outlets. It separates the dust-laden gas flow into a branch with low dust concentration and into a branch with high dust concentration. Mention is made of a cyclone the centrifugal force of which is enhanced by a secondary air flow. The dust particles thrown to the wall by the rotation are cought by the potential flow which transports them axially downward and through an anular slot into the lower section of the cyclone. Laminated separators, water separators, and acid mist separators were exhibited. The latter separates the gas flow into thin strands which are subjected to extremely high radial acceleration. The suspended particles coagulate and can be washed out with small quantities of scrubbing liquid. As far as filters are concerned, new materials, primarily fleeces of natural or synthetic fiber, were shown. Nomex (trade name for a heat resistant nylon fiber) is frequently used as a hot gas filter, since it withstands temperatures of up to 220 C. Envelope type filters prevailed over tubular filters. New shaking and rapping devices were shown. A mobile filter collects tar particles.

1394 APTIC NUMBER 17780

Watkins, E. R. and K. Darby
THE APPLICATION OF ELECTROSTATIC PRECIPITATION TO THE CONTROL OF FUME IN THE STEEL INDUSTRY. In: Fume Arrestment. Iron and Steel Inst., London (England), SR-83, p. 24-35, 1964. 5 refs.

The application of electrostatic precipitation to the steel industry for the control of high concentrations of red oxide fume from the use of tonnage oxygen is reviewed. The fume is characterized by concentrations of up to 25 grains/cu ft at NTP, including a high proportion of submicron particles. A very high efficiency of fume removal is therefore required to achieve the emission of less than 0.05 grains/cu ft which is necessary for a clear stack condition. The relationships between particle size, number, and light transmission through a plume are discussed, as well as factors affecting the efficiency of fume removal and precipitator efficiency: gas volume, gas distribution, electrical resistivity of dust fume, particle size, and dust concentration and electrode design. Mechanical problems of efficient precipitator design, and requirements for the electrode and hoppers and dust extraction systems, are treated in detail. Wet type precipitators are generally used for blast furnace gas cleaning, and dry type for sinter plant, OH furnace, and LD converter; both types can be applied to arc furnaces. Dry and wet systems of precipitation are compared in terms of gas volume to be treated, process efficiency, spray cooling towers, ancillary plant, stack discharge, and corrosion problems. A brief outline of some economic aspects is included; the amount of fume recovered represents a considerable portion of the furnace output; in some cases, the dust has appreciable recovery value.

1395 APTIC NUMBER 17422

Wedge, Utley and Frederic A. Eustis
RECOVERING SO2 OR THE LIKE FROM GASES CONTAINING THE SAME. (Assignee not given.) U. S. Pat. 1,260,492. 5p., March 26, 1918. (Appl. May 29, 1915, 12 claims).

A method for separating and recovering sulfur dioxide or the like from furnace and other gases involves the use of a series of absorption towers and entails first increasing the percentage of SO2 in the gases, then contacting the gases with water or other suitable liquid absorbents, and finally, while the liquid is under less than atmospheric pressure, heating it to a temperature approximate to but not exceeding the boiling temperature to release the SO2. The SO2-containing liquid is heated by a steam coil, and the heat combined with the action of a vacuum pump drives off the SO2 from the liquid. The release of the SO2 is aided and accelerated by the superficially extensive exposed surface of the liquid in its passage through coke packing and by agitation of the liquid.

1396 APTIC NUMBER 17233

Yamaki, Naoomi
AUTOMOBILE EXHAUST CONTROL AND RELATED GAS ANALYSIS. (Jidosha haiki gasu no johka narabini kanren bunseki hohhoh ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(2):100-108, Feb. 15, 1966. 2 refs.

Automobile emissions are divided into three categories: engine exhausts, crankcase emissions, and fuel evaporation. Among these, the most important is exhaust gas which contains the major part of carbon monoxide and nitrogen oxides. The principal ingredients of crankcase and evaporation emissions are hydrocarbons, the control of which is effected by the method of collecting and reburning. Air pollutants from automobiles are categorized as those due to incomplete combustion, those due to air intake, and those due to fuel components. The first category is reduced by complete combustion which increases the third category. Exhaust gas cleaning methods are grouped according to fuel modification, exhaust gas cleaners, and engine modification. To obtain complete combustion, afterburners are installed on exhaust pipes. Engine modification involves the redesign of air intake systems or the introduction of manifold air jets. Nitrogen oxides cannot be removed by the above methods. Of the two methods for their control, the most hopeful method is to recirculate exhaust gas to the intake air system. The removal efficiency of this method is above 80%. Hydrocarbons, carbon monoxide, and carbon dioxide are measured by infrared analysis, hydrogen flame ionization analysis, gas chromatography, etc. The phenol disulfonic acid method is standard for the analysis of nitrogen oxides, but unsuited to successive analysis. The optical analysis method is a potential successive method.

1397 APTIC NUMBER 12480

Yamamoto, Tadashi, Shozo Matsuda, Toshihide Okuno, Hideki Tanaka, Masahiko Tsuji
OFFENSIVE ODORS. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 2(1):48-59, 1967. Translated from Japanese. 53p.

Sixteen short reports on various aspects of odor pollution in Japan are presented. Analyses of amines and of odors from petroleum refineries, marine processing and fish handling plants, KP plants and vinyl chloride 'leather' factories, usually made by gas chromatography, are described, as well as the development of a container for collecting samples to be analyzed by this method. Surveys of the extent and composition of odor pollution, and of control programs, are given for Hokkaido and Tokyo. Other reports on control projects describe a method of eliminating odors from fish entrails by use of bamboo leaves, and countermeasures taken in an Osaka chemical plant. Odorimetry techniques by sensory perception in an odor-free room, by detection tubes, by the air dilution method, and by the saline solution equilibration method are reported. These documents are abstracted individually under APTIC numbers 17628 through 17641.

1398 APTIC NUMBER 17424

Young, P. A., K. H. Pearson, and C. O. Beale
THE GENERATION AND TREATMENT OF SINTER PLANT DUSTS. American Inst. of Mining, Metallurgical and Petroleum Engineers (AIME), New York, N. Y., Proc. Am. Inst. Mining Met. Petrol. Engrs. Conf. Blast Furnace, Materials 1961, vol. 20:299-313. 6 refs.

The design and use of settling chambers, cyclones, and electrostatic precipitators are considered in relation to United Kingdom sintering practice. Eighty to 95% of the stack-gas dust particles produced by this practice are less than 1000 micron; 38 to 65%, less than 100 micron; 4 to 19%, less than 10 micron; and 0.3 to 4%, less than two micron. The grain per ncf concentration is approximately 0.3 to 1.0. When 0.15 grains ncf in stack effluent can be tolerated and where there is adequate room, a settling chamber is suitable, expecially with dust containing not too high a proportion below 100 micron. A major advantage of such chambers is the very low pressure drop. Cyclones can be used to clean down to 0.10 grains per ncf, with the disadvantage of high pressure drop and consequent large power consumption. Where very large gas volumes and high suctions are involved, cyclones may be uneconomical. Electrostatic precipitators have the disadvantage of high capital cost, but pressure drops are very low and main stack gases are readily cleaned down to 0.05 grains per ncf. The main difficulty is to avoid condensation (and hence corrosion); means should also be provided for heating the system, particularly during start-up. Short settling chambers, simple inertial cleaners, or low pressure-drop cyclones may precede the precipitator to remove larger particles. Tip end gases can be readily cleaned down to 0.5 grains per ncf using banks of high efficiency cyclones.

1399 APTIC NUMBER 11847

Zawadzki, Edward A.
STATUS OF THE DEVELOPMENT OF PROCESSES FOR CONTROLLING SO_2 EMISSIONS FROM STATIONARY SOURCES. Preprint, National Limestone Inst., Inc., Washington, D. C., 15p., 1969. (Presented at the National Limestone Institute, Inc., 24th Annual Convention, Jan. 16, 1969.

The principle sources of sulfur dioxide emissions in the United States are utility plants and, to a lesser degree, industrial-size stationary combustion units and smelters. By 1980, the estimated amount of sulfur dioxide emitted to the atmosphere annually will increase to 50 million tons, double the current rate. Controlling the emissions is difficult, and only limited success has been achieved to date. The principle factors affecting the development of pollution control systems, especially for power plant utilities, are size of unit, age of unit, load factor, and geographic location. In spite of the difficulties associated with the processing of flue gases, a large number of processes have been developed. They fall into two main classes: sulfur recovery systems that produce a product, and nonrecovery systems that yield innocuous wastes. The process that appears most readily adapted to existing power stations of all sizes is the dry limestone injection process. The capital cost of the process for a 200-megawatt station ranges from 1.2 to 1.6 million dollars. Annual operating cost is about 0.4 to 0.5 million, with about 20-25% of the cost attributed to the cost of limestone. Most other SO_2 control processes are not economically suited to 200-megawatt and smaller stations.

1400 APTIC NUMBER 11629

Zwilling, J. P. and G. Guyot
RECOVERY OF THE WASTE GASES FROM CLAUS UNITS FOR THE PRODUCTION OF SULFURIC ACID. Erdoel Kohle (Hamburg), 21(5):290-292, May 1968. (Presented at the 19th Annual Meeting of the German Society for Petrology and Coal Chemistry, Hamburg, Oct. 6, 1967.) Translated from German. 8p.

At a natural gas purification plant, separated acid gas is processed to sulfur in a Claus unit. Since five percent of the sulfur was removed as sulfur dioxide with the waste gases, a continuous catalytic oxidation process was developed to convert sulfur compounds to sulfur trioxide and to recover concentrated sulfuric acid. The oxidation of the sulfur compounds is preceded by the combustion of residual gases at 540 C to oxidize hydrogen sulfide to sulfur dioxide and by the subsequent cooling of the combustion gases at 410 C. The sulfur-containing gases are then contacted with a vanadium catalyst in an adiabatic converter; oxidation takes place with the release of heat. Gases leaving the converter are cooled to 275 C and then passed to a concentration tower where they are contacted with 90-94% sulfuric acid in a counterflow precedure. Gases from the concentration tower flow to an absorption tower where the sulfuric acid vapors are scrubbed with 80-85% sulfuric acid. The gases impart their heat to the acid; since the absorption by the sulfuric acid also generates heat, the circulation absorption-sulfuric acid is cooled in graphite exchangers. Any acid remaining in the gases is removed by a Teflon filter; no electrostatic filters are required. Production of sulfuric acid is 65,000 to 140,000 ton/yr. The concentration of the acid is 91-94%.

MEASUREMENT METHODS

1401 APTIC NUMBER 17431

Advanced Metals Research Corp., Burlington, Mass.
ELECTRON MICROPROBE X-RAY ANALYSIS OF ATMOSPHERIC AEROSOL PARTICLES. Contract CPA 22-69-26, 77p., 1969. 5 refs.

Electron microprobe analysis was applied to the chemical identification of the airborne particles characteristic of air pollution contaminants. A conventional electron microprobe and an electron microscope equipped with an X-ray spectrometer attachment were employed to investigate size-fractioned samples of laboratory-generated aerosol particles of NaCl and $Zn(NH_4)_2(SO_4)_2$, as well as Los Angeles smog and motor exhaust. Attempts to analyze particles of sodium chloride test aerosol were unsuccessful, due to the visible decomposition of the particles under electron bombardment. As a result, the NaCl test aerosol could not be used to determine the effect of electron acceleration potential or beam size and current on the production of characteristic X-rays in particles of varying size. The zinc ammonium sulfate test aerosols were satisfactory for evaluating electron microanalyzer variables. Atmospheric aerosol particles were mounted on polished Be substrates, and stage three and five particles were analyzed. Stage five consisted of a very fine, densely packed particulate dispersion, stage three of coarser and more widely separated particles. Particles from stage three consisted predominantly of Ca, Si, and Fe. The presence of Al, Mg, and Ti compounds and Ca compounds (e.g., CaO or $CaCO_3$) was also indicated. Particulate matter in stage five was composed mainly of S, C, and O with traces of Fe and Si. The presence of organic matter on this stage was subsequently confirmed by scanning electron microscopy. The results obtained with the atmospheric aerosols strongly parallel those obtained previouly from coal combustion products, indicating the latter as a possible source of the atmospheric aerosol contaminants.

1402 APTIC NUMBER 18130

Alcocer, A. E., L. D. Potter, M. Feldstein, and H. Moore
THE COLLECTION AND ANALYSIS OF INORGANIC DUST DOWNWIND OF SOURCE EFFLUENTS. J. Air Pollution Control Assoc., 19(4):236-238, April 1969. 6 refs.

Two directionally oriented high-volume samplers are used to pinpoint the collection of specific inorganic dusts from an industrial emission. One of the samplers is placed upwind of the source, and the other downwind. Both samplers are activated by winds blowing from the direction of the source of the downwind sampler. Both are de-activated when the wind shifts from the 30 degree sampling arc. Thus, the upwind sampler "sees" background dust, and the downwind sampler "sees" material originating from the source. Microsorban filters are used to collect the dust materials. The filter is then dissolved in benzene and the residue washed with benzene to remove the filter material and organic substances collected. The residue consists of dry, inorganic dust, which is then subjected to X-ray diffraction and optical microscopy for analysis. This technique was successfully used to collect and analyze cement dust and mica dust from two separate industrial sources. The technique has promise for the analysis of a wide variety of inorganic materials which can be identified by x-ray diffraction, optical microscopy, or other techniques. (Author's Abstract)

1403 APTIC NUMBER 18125

ANALYTICAL GUIDES. LEAD. Am. Ind. Hyg. Assoc. J., 30(1):102-105, Jan.-Feb. 1969. 22 refs.

As part of a series of analytical guides, methods suitable for the determination of lead and beryllium are discussed. In the dithizone method for Pb, the Pb is quantitatively extracted from a basic solution by dithizone in chloroform. The absorbance of the red-colored complex may be measured spectrophotometrically at a wave length centered about 510 m micron. In the spectrographic determination of beryllium, the sample is subjected to arc or spark excitation with or without the use of an internal standard, and plate density is measured with a suitable densitometer. In the second method for determining Be, morin reacts with Be in alkaline solution to yield a complex whose fluorescent intensity is proportional to Be concentration. The sample is excited by an ultraviolet lamp transmitting at either 365 or 435 m micron, and the resulting fluorescence has an emission maximum at 550 m micron.

1404 APTIC NUMBER 11998

Andreatch, A. J.
OXYGEN EFFECT ON HYDROCARBON RESPONSE WITH THE FLAME IONIZATION DETECTOR. In: Report on CRC. Symposium on Exhaust Gas Analysis. Coordinating Research Council, Inc., New York, N. Y., CRC-MR-404, p. 13-21, 1965.

The effects of changes in oxygen concentration in the sample stream on the response of flame ionization detectors were investigated, using two Carad anaylzers; this oxygen effect is large and causes significant errors in total hydrocarbon analysis. The response for methane increases with increasing oxygen concentrations, while the response for acetylene decreases under the same conditions. An optimum operating condition is obtainable which gives a minimum deviation for a 0.21% oxygen range. The flame ionization detector responds to hydrocarbons on a carbon basis when no oxygen is present in the sample gas. Individual hydrocarbon response is significantly affected by oxygen in the sample gas; the optimum flow rate appears to be 16 ml/min for hydrogen and 10 ml/min for the sample with the 23 hypo jet used in the analyzer. Acetylene gave the largest deviation under these conditions. A 12% decrease in response was obtained at 10% oxygen. Methane, ethylene, and benzene standards were also tested, and the deviation was about the same as propane and acetylene. (Author summary modified)

1405 APTIC NUMBER 16755

Bamesberger, W. L. and Donald F. Adams
FIELD COMPARISON OF THE COULOMETRIC, COLORIMETRIC, AND LEAD ACETATE TAPE ANALYSIS METHODS FOR SULFUR-CONTAINING GASES. Tappi, 52(7):1302-1306, July 1969. 15 refs.

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A continuous, microcoulometric analyzer, utilizing preselective filtration, has been used for a field study of the varying atmospheric concentrations of sulfur dioxide, hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide in the vicinity of a kraft pulp mill. The microcoulometric analyzer was operated on a 5 min sequence for each of the five sulfur-containing compounds and a 5 min instrument blank, thereby yielding a complete analysis cycle every 30 min. Another coulometric analyzer with lower sensitivity was used as a a total sulfur gas analyzer. Comparative 2-hr average data were obtained for H_2S and SO_2 by using midget impingers in a sequence sampler. Chemical analyses were conducted by the cadmium hydroxide---STRactan---methylene blue and modified West-Gaeke methods, respectively. A third comparison for H_2S was obtained by using the lead acetate tape method. The data show agreement for H_2S by the microcoulometric and cadmium hydroxide---STRactan---methylene blue methods but not with the lead acetate tape technique. Agreement was also obtained for SO_2 by the microcoulometric and modified West-Gaeke methods, although all observed SO_2 levels were near the sensitivity limits for these methods. (Author's Abstract)

1406 APTIC NUMBER 12337

Bellar, Thomas A. and John E. Sigsby, Jr.
DIRECT GAS-CHROMATOGRAPHIC ANALYSIS OF LIGHT OXYGENATED MATERIALS IN EMISSIONS FROM AUTOMOTIVE AND OTHER COMBUSTION SOURCES. Preprint, Public Health Service, Cincinnati, Ohio, National Air Pollution Control Administration, 22p., 1968 (?). 9 refs.

An automated, gas-chromatographic method is described for direct analysis of C2 through C4 aldehydes, C3 and C4 ketones, and various other oxygen-, nitrogen-, and halogen-containing hydrocarbons present in combustion effluents. Interfering hydrocarbons in the C1 to C8 range are first removed by passing the sample through a 0.180-in. ID cutter column 12 feet long, containing 20% 1, 2, 3-tris (2-cyanoethoxy) propane on a 45-60 mesh maintained at 22 C. This column is backflushed, and the backflush peak, containing the compounds of interest, is transferred to a 0.105-in. ID trap 12 in. long, containing 10% sucrose octa-acetate on a 60-80 mesh maintained at -55 C. The trapped contents are then transferred to the analytical column by programming the trap at the rate of 12 deg/sec to 100 C. The analytical column is 12 ft of No. 304 stainless steel tubing, 0.105 in. ID, packed with 50-80 mesh maintained at 156 C. The limit of detection for the system is 0.05 ppm acetaldehyde. Retention times are given for a great variety of the compounds this system is capable of analyzing, and examples of chromatograms are included from the analysis of samples of auto exhaust, trench incineration effluents, and ambient air. (Author abstract modified)

1407 APTIC NUMBER 17777

Benario, Michael and Daniel Bodin
A SIMPLE PORTABLE DEVICE FOR THE CONTINUOUS MEASUREMENT OF THE CONCENTRATION OF SUSPENDED MATTER AND TRACE GASES IN THE OUTSIDE AIR. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(6):26-29, June 1969.

An instrument for continuously measuring suspended matter and trace gases in outside air is described in which an air stream is generated by catalytic oxidation of methanol. In this way the air can be sucked through an electroprecipitor or through a layer of gas absorbent. The amount of aspirated air is about 1000 times the methanol mass. The aspiration effects in still laboratory and gusty outside air show deviation of plus or minus 12% from the mean value. (Author summary modified)

1408 APTIC NUMBER 11631

Benario, Michel and Bui-The-Chuong
UTILIZATION OF CERTAIN PLASTICS IN THE SAMPLING AND STORAGE OF POLLUTED AIR. (Sur l'utilisation de certaines matieres plastiques pour le prelevement et la conservation des echantillons d'atmospheres polluees). Preprint, Institut National de Recherche Chemique Appliquee, Vert-Le-Petit (France), Nov. 6, 1968. 8 refs. Translated from French. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 9p.

Because the use of plastic bags for the sampling and storage of polluted air often results in the loss of pollutants, various plastic materials were compared with respect to their permeability to sulfur dioxide. The results are presented in a table of permeability, diffusion, and solubility constants. The physical phenomenon of loss due to the diffusion and dissolution of the gas is discussed. A Mylar spherical 100-liter bag 50 micron thick containing air with approximately 1 ppm SO_2 loses 1.6% of the SO_2 over 24 hrs in an environment of 0 ppm SO_2. Materials with a lower permeability for SO_2 are methyl polymethacrylate, Lumiphane, Vinyril, and Nomex. In addition, permeability is diminished by the incorporation of a metal into the film.

1409 APTIC NUMBER 17799

Bernert, Juergen
RECENT FINDINGS IN INVESTIGATING EMISSIONS OF INDUSTRIAL PLANTS. (Neuere Erkenntnisse bei der Untersuchung von Emissionen industrieller Anlagen). Text in German. Chimia, 21(7):285-290, July 1967. 25 refs.

German air-pollution-control legislation empowers local authorities to order the determination of the kind and amount of smoke, soot, dust, gases, vapors, odors, shocks, noises, heat, energy, radiations, and vibrations emitted by industrial installations. Since the industrial supervisory authorities do not possess any facilities to make the necessary measurements themselves, the owner of the installation must use the facilities usually prescribed by the Department of Labor. The experiences are described of such a measuring and appraising bureau as far as measurements are concerned. For dust measurements, the small dust meter designed by Lurgi and the Warmestelle of the Society of German Steelmen (VDEH) is frequently used, since it can be handled easily at poorly accessible or hot locations. Hot, moist gases with active components cause corrosion inside the aluminum cylinder protected by a sheet-steel housing, which render its inner surface rough and granular. Hard and sharp-edged dusts have the same effect. Thus, the dust tends to deposit on this surface rather than on the measuring filter, causing serious errors, particularly at low dust concentrations. Replacement by a cylinder of V4A steel cured the problem. Inlet and outlet connections and plastic or rubber hoses may be sources of serious errors. For gas measurements, the so-called impinger-washer has proved to be particularly successful. Organic gases in industrial waste gases are difficult to determine; in many cases, their identity is not known a priori. For sampling and on-site analysis, gas-sensing tubes, explosimeters and flame-ionization detectors are commonly used, while for sampling and laboratory determination, one uses gas chromatography, infrared spectroscopy, and Stratman's silica gel tubes. On-site analysis is difficult and costly, so that the latter three methods are commonly used after collecting gas samples by sucking in a known amount of gas over a gas meter, manometer and thermometer, and absorbing them in special absorber jars.

1410 APTIC NUMBER 11997

Biller, W. F.
DETERMINATION OF TOTAL HYDROCARBON BY NONDISPERSIVE INFRARED
ANALYZERS. In: Report on CRC Symposium on Exhaust Gas Analysis.
Coordinating Research Council, Inc., New York, N. Y., CRC-MN-404,
p. 5-12, 1965.

The nondispersive character of the infrared analyzer results from the use of a broad spectrum of radiation. A high degree of selectivity is achieved by using the compound being detected as its own detector; e.g., n-hexane at 90 mm. Hg, used for hydrocarbon detection, senses a C-H stretching frequency at about 3.4. micron. Sampling is an important step in exhaust gas analysis, and in this connection it is most important that a condenser remove the excess water vapor and that the fiberglass filter be 99.9% efficient down to 0.1 micron particles. Several NDIR instruments are sometimes used in parallel or in series to obtain simultaneous determinations of hydrocarbons, carbon monoxide, and carbon dioxide. Two hydrocarbon instruments are needed to cover the range of hydrocarbon concentrations in the exhaust. The response characteristics of the NDIR analyzer in theory and under various operating situations are reviewed. The instrument's advantages in determining hydrocarbons are its continuous response, specificity; fast response, and convenience and relative simplicity of operation. Its drawbacks are nonuniform response to hydrocarbons, instability, requirement for clean sample gas, and calibration requirements. A summary of necessary instrument maintenance checks is included.

1411 APTIC NUMBER 17527

Boudreau, Robert D.
ON THE USE OF ULTRAVIOLET LIDAR FOR OBSERVING ATMOSPHERIC
CONSTITUENTS BY RAMAN SCATTERING. J. APPL. METEOROL., 9(2):
316-317, April 1970. 5 refs.

The Raman scattering technique, unlike ordinary scattering techniques, can isolate the scattering signal from a specific atmospheric constituent and therefore be used to determine the concentration of the constituent. A 3371 A pulsed nitrogen laser was chosen previously in preference to a 6940 A ruby laser for reasons of photo-efficiency (which is approximately 25 times greater for ultraviolet) and because the Raman scattering cross section is inversely proportional to the fourth power of the incident wavelength (which makes the nitrogen lidar more effective by a factor of 17.96). Attenuation of the lidar pulse by air molecules depletes the pulse by Rayleigh scattering, and since the Rayleigh scattering cross section is also inversely proportional to the fourth power of the incident wavelength, use of an ultraviolet wavelength would also result in increased attenuation of the lidar pulse. Examination of the net effect of these two counteracting factors reveals that 163 kilometers is the distance within which one can shift to shorter wavelengths to achieve an increase in the back-scattered signal if a ruby lidar is being used to observe an atmospheric constituent like nitrogen. With the nitrogen lidar wavelength, the distance is lowered to 7.4 kilometers, and the increased attenuation does not offset the increased backscatter for ranges less than 21.3 kilometers.

1412 APTIC NUMBER 17533

Boyd, A. William, Clive Willis, and Ronald Cyr
NEW DETERMINATION OF STOICHIOMETRY OF THE IODOMETRIC METHOD FOR
OZONE ANALYSIS AT PH 7.0. Anal. Chem., 42(6):670-672, May 1970.
17 refs.

A previous comparison of the optical method of ozone determination with that of oxidation of iodide in buffered neutral solution showed that one molecule of ozone liberated more than one molecule of iodine. Because of disagreements over the ratio of molecules of iodide to molecules liberated at pH 7, the stoichiometry of the iodide method was reexamined at a pH of 7.0. The optical and iodide methods were again compared. The average concentration of ozone formed per unit dose, as measured optically, was 2.108 plus or minus 0.128 times 10 to the minus 25th power mole reciprocal eV. The amount of I(3-) liberated by the iodide method was 3.222 plus or minus 0.157 times 10 to the 25th mole reciprocal eV. The ratio of these values gives the stoichiometry of the ozone-iodide reaction as 1.53 plus or minus 0.12 molecules of idoine liberated per molecule of ozone. The results are discussed in terms of iodide liberation under alkaline conditions.

1413 APTIC NUMBER 17545

Breuer, Wolfram and Kurt Schreckling
AN APPARATUS FOR CONTINUOUS PRODUCTION OF EXACT GAS TRACE
CONCENTRATIONS FOR CHECKING ANALYTICAL PROCEDURES. (Eine
Anordnung zur kontinuierlichen Erzeugung genauer
Gasspurenkonzentrationen fuer die Ueberprufung analytischer
Verfahren). Text in German. Arch. Tech. Messen, V723(408):
5-10, Jan. 1970. 3 refs.

An apparatus for continuous production of exact gas trace concentrations is intended to be used for checking analytical procedures; it can also be used in other situations in which exact gas trace concentrations are required. The method of absolute calibration involving the use of known amounts of the trace and carrier gases is applicable to many gas trace concentration measuring apparatus. The required accuracy can be attained by exact specification of the rates of flow of the trace and carrier gases in terms of their volume and time. This is achieved by the use of the known rotating gas dosage cock in conjunction with refined calibration and correction procedures. After explaining the principle of dosage used, the design of the dosage unit is described. The method of determining the working volume of the gas dosage cock is described as well as the method of maintaining the rate of flow of the carrier gas at the desired value. Any number of standard-size dosage, cock calibration, and gas flow calibration units can be combined to a calibration station. The units in terms of which the trace gas concentrations are determined are given. Defining this concentration as the ratio c. of the volume of the trace gas/volume of the dry carrier gas, in parts per million. The conversion formulas for expressing it four different ways is presented.

1414 APTIC NUMBER 18065

Brink, J. A., Jr. and J. D. Porthouse
EFFICIENT DUST CONTROL VIA NEW SAMPLING TECHNIQUE. Chem. Eng., 76(5):106-110, March 10, 1969. 6 refs.

A total dust sampler is a large sampling device that is capable of handling an entire process gas stream. For extremely large process streams, where the gas flow rate may be thousands of cfm, a total sampler would be excessively bulky and expensive. However, there are many pieces of process equipment with air requirements low enough to be handled by a total sampler. A total system developed at Monsanto Co. is described in detail. The advantages of the sampling procedure and the analysis of the results are discussed.

1415 APTIC NUMBER 12300

Bykhovskaya, M. S. and R. N. Makedonskaya
DETERMINATION OF LITHIUM IN AIR. (Opredelenie litiya v vozdukhe). Hyg. Sani., 33(7-9):366-370, July-Sept. 1968. 16 refs.

A spectrophotometric method is described for determining microgram amounts of lithium in air in the presence of larger amounts of magnesium and aluminum, using the reagent nitroanthranilazo. The sensitivity is 0.3 micrograms Li in the analytical volume. Conditions were elaborated for the polarographic determination of lithium in the presence of magnesium and aluminum; the sensitivity is 3 micrograms Li per ml. Both the photometric and polarographic determinations are recommended. The total level of dust, the lithium and magnesium content, and total alkalinity can be determined from a single industrial sample. The method is applicable in the industrial production of magnesium-lithium alloys which sometimes forms a condensation aerosol of magnesium and lithium (and in certain cases, aluminum). (Author conclusions modified)

1416 APTIC NUMBER 17425

Carney, D. J., A. J. Deacon, and T. L. Batina
CONTINUOUS ANALYSIS OF IRON BLAST FURNACE TOP GAS. American Inst. of Mining, Metallurgical and Petroleum Engineers (AIME), New York, N. Y., Proc. Am. Inst. Mining Met. Petrol. Engrs. Conf. Blast Furnace, Materials 1954, vol. 13:142-157. 7 refs.

Variations in blast furnace top gas composition were determined with a continuous gas analyzer installed on two modern 28-ft hearth furnaces; an attempt was made to correlate the variations with blast furnace operation. In the three-year study, blast furnace operating data were obtained from blast furnace records and were averaged daily. Gas samples were withdrawn periodically at the analyzer and their composition was determined by the Orsat method. The average carbon monoxide content varied from 20 to 24%; carbon dioxide, from 12 to 17%; and hydrogen, from 1.2 to 3.0%. One of the few direct relationships observed was the correlation of iron-production rate with top gas composition. Production was greater when the CO/CO2 ratio was low (1.5 to 1.7) than when the ratio was high (2.0 to 2.2). A direct relationship between moisture in the blast and hydrogen in the top gas was also obtained for from 1 to 12.5 grains of moisture per cu ft of blast. Top gas composition calculated by a modification of the Joseph technique agreed reasonably well with actual measured composition.

1417 APTIC NUMBER 12399

Collis, Ronald T. H. and John W. Oblanas
LIDAR OBSERVATIONS OF DEBRIS CLOUDS FROM NUCLEAR CRATERING DETONATIONS. (FINAL REPORT). Stanford Research Inst., Menlo Park, Calif., Contract AT(04-3)-115, SRI Proj. 6916, 78p., Aug. 1968. 12 refs.
CFSTI: UCRL 13360

Lidar (laser radar) observations of nuclear debris clouds from the Cabriolet and Buggy detonations in Nevada in 1968 are described. The lidar data were analyzed for information on cloud position, dimensions, and reflectivity for various times after detonation. Additional aims were to study techniques and instruments for using lidar in nuclear cloud monitoring, and to provide information on the dimensions, motion, and composition of the cloud. The observations were made with an experimental ruby lidar capable of firing once per 30 sec. In the Buggy test, lidar data on cloud location was used to direct a particle-sampling aircraft that gathered data on particle size distribution within the cloud. It is concluded that the lidar tests were generally inadequate, producing little information on the debris clouds; limiting factors were the data rate, fixed location, and performance of the experimental equipment. However, from this and other experience, it is believed that lidar data can provide geometric information on the cloud envelope. In the initial stages, when the cloud is dense, this information will be limited to the near surface of the cloud; as the cloud becomes more diffuse, and particularly when subvisible, lidar can penetrate it for data on its internal structure and farther boundary. In addition, quantitative data on the distribution of mass concentration within the cloud and its change with time could be acquired by lidar with sufficient accuracy to study diffusion processes and to track significant structures within the cloud.

1418 APTIC NUMBER 12179

Couchman, J. C.
USE OF CASCADE IMPACTORS FOR ANALYZING AIRBORNE PARTICLES OF HIGH SPECIFIC GRAVITY. Oak Ridge National Lab., Tenn., Intern. Symp. Fission Prod. Release Transport Under Accident Conditions, Oak Ridge, Tenn. April 1965, p. 1163-1203. 6 refs. (April 5-7.)
CFSTI: CONF-650407 (vol.2)

Air sampling support for Operation Roller Coaster, a field test carried out at the Tonopah Test Range, Nevada obtained information on the transport and storage of plutonium-bearing weapons. Air samplers operated upon the impaction principle. Calibration of the Casella cascade impactor was made with commercially available unit-density, polystyrene latex spherical particles; metallic spheres (gold, aluminum, nickel, and platinum) were prepared from fine-wire inductors by a special electrical-discharge technique. A simplified method for determining a cascade stage efficiency curve which obviates the need to measure the total number of particles in a distribution was devised and is presented, in addition to efficiency curves derived for Casella and Andersen cascade impactors. Methods of using cascade impactors to analyze an unknown aerosol are described and examples are given. Two methods of determining aerodynamic size distribution are explained: effective cutoff diameter method, and median diameter method. A design for a special macroscopic densitometer for measuring the density of an unknown effluent is proposed. Various known techniques for measuring shape factors are compared. Best results, occurred with measurement of the average value between minimum and maximum diameters or with measurement of the circle of equivalent area. Means of determining respirable dose fraction on the basis of impactor stage efficiency curves are presented.

1419 APTIC NUMBER 11707

Cramers, Carolus Alfonsus
SOME PROBLEMS ENCOUNTERED IN HIGH RESOLUTION GAS CHROMATOGRAPHY. Technische Hogeschool, Eindhoven (Netherlands), Thesis (Ph.D.), Dec. 12, 1967, 135p. 54 refs.
CFSTI: N68-16069

Two aspects of resolution gas chromatography were presented: improving the accuracy and sample requirements or injection systems for use with high efficiency open hole tubular columns; and developing methods to decrease the sample requirements for identification. The theoretical influence of the injection procedure on both the resolution and the accuracy of qualitative analysis to be obtained with high resolution columns was discussed. Possible causes of alinearity in a stream splitting injection device were discussed which leading to a design of improved quantitative accuracy. The development of injection systems for use with capillary columns, which avoids the need of sample splitting, was described. In this way, the accuracy of quantitative analysis of wide boiling mixtures can be improved. Also sample size is no longer set by the requirements of the injection system. The potential value of accurate retention data in the characterization of volatiles was emphasized. A list of accurate retention data of 150 hydrocarbons on both apolar and apolar stationary phase was given. The potentialities of pyrolysis gas chromatography (PGC) as a tool for characterization and structure elucidation of volatile organic substances were discussed. In PGC, the products of controlled thermal degradation of a sample are separated on a chromatographic column. A PGC-system for volatile components was developed, including a micro flow reactor permitting accurate temperature and reaction time control. To check the suitability for kinetic measurements of the PGC-setup, ethylacetate and cyclopropane were cracked. The analytical aspects of PGC, such as repeatability and reproducibility, were discussed. The application of the PGC-system to the study of reaction rates and product distribution of the thermal degradation on saturated hydrocarbons were discussed.

1420 APTIC NUMBER 12325

Curtis, John J.
AN EVALUATION OF TWO LARGE-VOLUME AIR-SAMPLING DEVICES. Fort Detrick, Frederick, Md., Applied Aerobiology Div., 1X650212D619, TM-152, 34p., Jan. 1969. 5 refs.

Two air samplers that use electrostatic precipitation as the primary means of collection were evaluated for use in sampling biologic aerosols of diverse concentrations. The testing program is described. The Model M Large-Volume Air Sampler(LVAS-M) was the most effective in sampling bacterial, viral, and rickettsial aerosols. In very dilute concentrations, the device can produce estimates of aerosol concentration when conventional sampling equipment fails. The sampler is most effective when operated in a level position, constantly monitored by a trained technician, and not subjected to fluctuation in electrical current. In still air, using a complex enriched medium for collection and assaying the collected fluids immediately, the LVAS-M produces aerosol concentration estimates comparable with those obtained with the GP-20 liquid impinger sampler, i.e., it is equal in effiancy and about 300 times as sensitive. The sampler can probably be modified to perform under almost any test situation, including remote unattended operation in marine atmospheres. (Author conclusions modified)

1421 APTIC NUMBER 11793

DeLuisi, John J.
THE EFFECT OF HAZE UPON UMKEHR MEASUREMENTS. Florida State Univ., Tallahassee, Dept. of Meteorology, OAR Contract AF 19(628)-4953, Proj. 8628, Task 862807, Work Unit 86280701, AFCRL-67-0367, SR-67-3, 175p., July 1, 1967. 60 refs.

The Umkehr method measures the vertical distribution of ozone. The use of Mie-scattering functions in a primary-scattering model showed that haze affects an Umkehr curve by slightly increasing the N-values for zenith angles of about 60-75 deg, and slightly decreasing the N-values for zenith angles of about 75-90 deg. A cross-over point was implied. Another implication derived for the model calculations was that the type and amount of variation of the Umkehr curve depended on the total optical depth of haze particles and not on the size distribution and refractive index of the haze particles, within reasonable limits of variation. The existence of simultaneous ballon-Umkehr data permits an experimental analysis of the influence of haze upon Umkehr curves. Both model and experimental results showed that for a C-wavelength-pair Umkehr curve that was normalized to zero at a zenith angle of 60 deg, the presence of haze decreases the N-values (on the average) by a maximum value of 2 at a zenith angle of 80 deg. From the experimental haze residual, a total average optical depth of haze particles of 0.30-0.33 is inferred for a standard clear atmosphere over Tallahassee. The reversals were observed in the general haze-residual curves normalized at 60 deg; for the C-wavelength pair a minimum occurred at about 80 deg and a maximum occurred at about 88 deg. The positions of the reversals were attributed to the way in which haze particles are distributed in the vertical. Umkehr curves that were adjusted for an average haze effect produced ozone distributions that agreed better with the simultaneously measured ballon ozone distributions. (Author abstract modified)

1422 APTIC NUMBER 12306

Dudley, Jared K., Eloy F. Lozano, Roland S. Yunghans, and Joseph J. Bufalini
CONTINUOUS MONITORING FOR ATMOSPHERIC TOTAL OXIDANT AND SIMULTANEOUS DETERMINATION OF OZONE BY GAS PHASE TITRATION. Preprint, Air Pollution Control Association, New York City, 14p., 1969. 4 refs. (Presented at the Air Pollution Control Association Annual Meeting, 62nd, New York, June 22-26, 1969, Paper 69-87.)

The adoption of Technicon Autoanalyzer System for simultaneous, continuous monitoring of total oxidant and ozone in ambient air is described. With this method, specificity for ozone is achieved by periodic gas phase titration of the sample stream. Total oxidants are absorbed form the atmosphere by neutral buffered potassium iodide by cocurrent extraction in a 300-mm spiral column (2 turns per inch) packed with 5-mm glass beads. The absorbance is measured at a wavelength of 340 millimicrons with a phototube colorimeter, using a 50-mm tubular flow cell. The gas phase titration of ozone by trans-2-butene uses an unpacked spiral column, equal in length to the absorbing column, as a reaction chamber. This chamber is placed up-stream from the absorbing column. The ambient air sample is titrated periodically at fixed intervals with the trans-2-butene to obtain the ozone concentration. The collection efficiency of the column is approximately 98% and the titration efficiency of the trans-2-butene is about 95%. Interference by sulfur dioxide is eliminated by a chromium trioxide scrubber. Laboratory operation indicates that this method will measure ozone concentrations by difference as the ozone is selectively removed from ambient air containing other oxidants. It will detect total oxidant concentrations of as low as 0.005 ppm as ozone. (Author abstract modified)

1423 APTIC NUMBER 17772

Duuren Van, B. L.
SEPARATION AND IDENTIFICATION OF ALIPHATIC AND AROMATIC CARCINOGENS FROM ENVIRONMENTAL SOURCES. Nat. Cancer Inst. Monograph, no. 9:135-151, 1962. 12 refs. (Presented at the Symposium on the Analysis of Carcinogenic Air Pollutants, Cincinnati, Ohio, Aug. 29-31, 1961.)

The methodology of experiments in the separation and identification of carcinogens in tobacco smoke, the results of which are published elsewhere, is discussed here by way of offering guidelines for air pollution research. Paper chromatography was used, followed by ultraviolt and fluorescence spectroscopy, the separations being obtained with Tarbell's procedure, using dimethylformamide-hexane as the solvent. Such products as the 5,6-quinone and 7,14-quinone obtained from dibenz(a)anthracene do not ordinarily fluoresce in organic solvents and remain at the origin of paper chromatograms in most systems. Their ultraviolet spectra are not readily distinguished from background absorption. Reductive acetylation with zinc dust and acetic anhydride converts this mixture of quinone to hydroxy-acetates, which can be more easily processed. In a dioxane solution, indole is readily distinguished from the various methylindoles, and in cyclohexane, it is possible to distinguish 2- and 3-methylindole. The compound 1-methyl-2-phenylindole exhibits a high florescence intensity, but 3-acetylindole does not fluoresce in the usual solvent. Special attention is given to the problems presented by compounds in the carbazole and acridine series. Of special interest in air pollution are the possible carcinogenic effects of the hydroperoxides, peroxides, epoxides, and lactones.

1424 APTIC NUMBER 12256

Feng, Paul
ION MOLECULE REACTIONS IN FLAMES. IIT Research Inst., Chicago, Ill., Contract AF 49(638)-1573, Proj. 9750-02, Task 6144501F, IITRI-U6023-1, 52p., Sept. 1968.
CFSTI, DDC: AD 676698

Studies of charge recombination and equilibrium were carried out in a number of hydrogen-oxygen flames containing selected additives including CH4, C2H6, C3H8, C4H10, CF4, CF3Cl, and C4F10; the methane content in the initial CH4-H2 mixture ranged from zero to 0.7 volume percent. Modified flame ionization detection systems and the associated electronics of a commercial gas chromatographic instrument were used and variations in the efficiency of ion collection were determined as functions of flame composition, collection voltage, and flame pressure. Analysis of the experimental data on the basis of the theory of ionization chambers showed that (1) although free electrons do constitute the most important negatively charged species, a considerable amount of heavier negative ions do exist in the flames studied in this program as the result of electron capture by oxygen or other molecular species; and (2) charge neutralization occurs to an appreciable extent even in the presence of external electric fields capable of collecting apparent saturation currents. In addition, the fact that the introduction of even non-combustible additives such as CF4 could result in increased ion currents (apparently due to chemi-ionization processes involving excited carbonaceous intermediates) suggests that this phenomenon could well be used for the analysis of such compounds by flame ionization methods. (Author abstract modified)

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1425 APTIC NUMBER 12414

Fiocco, Giorgio
INVESTIGATIONS OF DUST IN THE UPPER ATMOSPHERE BY OPTICAL RADAR. FINAL REPORT. Massachusetts, Inst. of Tech., Cambridge, Research Lab. of Electronics, NASA Grant NGR-22-009-(114), 10p., Nov. 30, 1968. 3 refs.
CFSTI: N69-15833

Conclusions reached by recent optical radar investigations of aerosol layers in the upper atmosphere are summarized. Also reported are the results of a preliminary study of the use of an optical homodyne spectrometer to investigate the spectrum of light scattered by aerosols. The homodyne spectrum gives information about the density correlation function of the particles. It is observed by measuring with a wave analyzer the low-frequency spectrum of the current from a photomultiplier tube illuminated by the scattered light. The homodyne spectrum is observable only with a laser source. During the time of the measurement, the turbulence should be statistically stationary. The volume observed should be large enough so that the broadening caused by the finite lifetime of the scattering from a particle through the volume can be neglected and small enough so that the mean velocity of the fluid is constant with the volume. The data obtained from measurements of the spectrum of light scattered by particles suspended in a submerged water-jet presented in the form of graphs.

1426 APTIC NUMBER 17549

Fischer, Robert
SPECTROPHOTOMETRIC PROCEDURE FOR A QUICK ESTIMATION OF THE AMOUNT OF POLYCYCLIC AROMATIC HYDROCARBONS IN SOOT SAMPLES. (Spektrophotometrisches Verfahren zur raschen Beurteilung von Russen auf ihren Gehalt an polycyclischen, aromatischen Kohlenwasserstoffen). Text in German. Z. Anal. Chem., 249(2): 110-115, 1970. 5 refs.

The amount of polycyclic aromatic hydrocarbons in a soot sample can be estimated by soxhlet extraction, purification of the extract on alumina, and determination of ultraviolet absorbance. The distinct values measured at 7 wave lengths are used for calculating the absorbance numbers (referred to 100 ml measuring volume, 1 cm irradiated layer, and 1 kg soot). The average value of the absorbance numbers, called chief absorbance number, characterizes the amount of polycyclic aromatic hydrocarbons of a soot extract. Chief absorbance-numbers below 1 are classified as extremely small; between 1 and 10, as small; and between 10 and 100 as moderate concentration. The reproduceability of the absorbance numbers is generally good with the exception of soots with non-uniform surface structure. Extraction is the most difficult operation of the process. Fine-grained soot poses no problems for extraction; pulverized soot is extremely difficult to extract. The results of 6 soot analyses are listed in a table. The chief absorbance number reflects the decreasing summarized concentrations of the 16 polycyclic substances satisfactorily. Deviations occur in the presence of compounds with extremely high or low substance specific factors.

1427 APTIC NUMBER 17798

Gil'denskiol'd, R. S. and S. M. Eting
AN IMPROVED GAS PIPETTE FOR LONG INTERVAL AIR SAMPLE COLLECTION. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:204-206, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

A pipette for collecting air samples of known volumes for a 24 hour period was described. The operating principle consists of a negative pressure created in the body of the pipette by the outflow of a saturated NaCl solution through a capillary. A pressure drop maintains a constant definite pressure on the capillary at all levels of the fluid in the body of the pipette. A hydrostatic pressure regulator is composed of a glass tube with a diameter of 0.4-0.6 cm. At the termination of air sampling, the NaCl saturated solution drops down to the level of the upper end of the capillary pipette, which is slightly above the lower end opening of the hydrostatic pressure regulator. This shuts off the connection between the collected air sample and the atmospheric air. A variable hydrostatic pressure device can be lengthened or shortened, so that the height of the fluid column can be raised or lowered, depending upon temperature changes throughout the day, thereby controlling the rate of the outflowing saturated NaCl solution. The variable hydrostatic pressure device is composed of a rubber tube with a diameter 0.5-0.7 cm with an inserted glass tube, forming a kind of movable sucker rod connection. The capillary controls the constant flow of the saturated NaCl solution at any desirable rate. At the conslusion of air sampling, a meniscus is formed in the capillary which acts as a lower liquid seal. A glass cylinder prevents the salting out of NaCl at the capillary tip. Saturation of the water with NaCl prevents the possible partial absorption by the fluid of the gas under investigation. It also prevents the solution from freezing.

1428 APTIC NUMBER 18098

Goetz, Alexander
A NEW INSTRUMENT FOR THE EVALUATION OF ENVIRONMENTAL AEROCOLLOIDS. Environ. Sci. Technol., 3(2):154-160, Feb. 1969. 18 refs.

A single-stage, multiple-slit impactor was designed to precipitate aerocolloidal particles in the submicron range on the metallic mirror surface of a slide, which moves perpendicular to two to four equal slit exits. This motion can be varied in exponential intervals over a range of 1 to 512 to obtain a sequence of deposit steps with uniform but varying density. Coagulation and mutual interference, inevitable in most other impaction processes, are avoided by control of the deposit density with the slide speed which is reproducible by synchronous drive. To determine the critical concentration at which coalescence occurs, a series of steplike deposits from each slit exit varying exponentially in density permits the correlation of particle number with air volume in the range of 1 to 1,000,000 per liter. The deposit density is determined by measuring the light-scattering levels microphotometrically under reflected dark-field illumination.

The multiple-slit arrangement facilitates comparison of deposits from different branches of the same air sample, prior to impaction exposed to high humidity, infrared, or ultraviolet irradiation, and indicates the hygroscopic, thermal, and photochemical stability of the prevailing aerocolloids. (Author's Abstract)

1429 APTIC NUMBER 12416

Gol'berg, M. A.
THE THEORY OF A TURBIDIMETRIC BACKSCATTERING INSTALLATION. (Teoriya nefelometricheskoy ustanovki obratnogo rasseyaniya). Tr. Nauchn.-Issled. Inst. Gidrometeorol. Priborostr., vol. 13, (no pagination given), 1965. 13 refs. Translated from Russian. Translation and Interpretation Div., Inst. of Modern Languages, Washington, D. C. 18p.
CFSTI, DDC: AD 680766

The article analyzes a series of theoretical problems connected with the operation of a backscattering turbidimetric installation. An equation is presented for determining the meteorological visibility distance obtainable with a photometer, provided a polarization visibility counter of the M-35 type is used. The nephelometric backscattering installation described permits measurements of the interrelation of the brightness of light scattered back under an angle close to 180 deg and brightness of the standard calibrating field. One of the possible procedures for the graduation of the installation is suggested, and optimal values of its basic parameters are recommended.

1430 APTIC NUMBER 17577

Griswold, S. Smith, Arthur A. Atkisson, Robert E. Neligan, Frank Bonamassa, and Wallace Linville
RESEARCH AND TEST FACILITIES OF THE LOS ANGELES COUNTY AIR POLLUTION CONTROL DISTRICT. Preprint, Air Pollution Control Association, New York City, 17p., 1962. 7 refs. (Presented at the Air Pollution Control Association Annual Meeting, 55th, Chicago, Ill., May 20-24, 1962, Paper 62-67.)

The research and testing facilities of the Los Angeles County Air Pollution Control district include the following: a dynamometer laboratory, in which samples of engine exhaust may be produced under widely variable but controlled conditions, and exposed to qualitative and quantitative analysis; an environmental laboratory, in which diluted mixtures of contaminants may be exposed to controlled irradiation and interaction in close simulation of actual atmospheric conditions, and in which the resultant effects may be monitored by a variety of objective techniques; and analytical facilities capable of providing quantitative and qualitative analysis of ambient air and source samples through such techniques as gas chromatography, mass spectrometry, infrared spectroscopy, flame ionization analysis, and wet chemical analysis. The facilities occupy approximately 12,000 sq ft of usable floor area. The dynamometer laboratory includes one programming engine dynamometer, one chassis dynamometer, and three engine dynamometers. The environmental laboratory has two irradiation chambers, each with an internal volume of 1000 cubic feet or 10,000 liters. The chambers serve the study of photochemical smog and other air pollution problems. All test facilities mentioned are described in detail and illustrated.

1431 APTIC NUMBER 11859

Gruber, Charles W. and Charles E. Schumann
OBJECTIVE MEASUREMENT OF SMOKE FROM COMBUSTION SOURCES. Am. Chem. Soc. Div. Fuel Chem. Preprints, 10(1):57-64, 1966. 6 refs. (Presented at the Symp. on Fossil Fuels and Environmental Pollution Joint with Div. of Water, Air, and Waste Chemistry, Pittsburgh, Pa., March 22-31, 1966.)

The suitability of the soiling index method for evaluating the source strength of smoke plumes in objective units is discussed. Satisfactory measurements were obtained in 17 field tests on nine different plants ranging from a small steel-fired tube boiler to a 225,000 lb water boiler, fired by a pulverized fuel burner. The sampler used was a Soiling Potential Sampler which is arranged to draw a variable sample of combustion gases either directly through filter tape or through a circuit which first dilutes the sample from the source. The spots are evaluated by a reflectance meter and the soiling potential is calculated in terms of Rud-ft 2/cu ft of gas sampled. The average value of soiling potential per cu ft of stack gas for 16 tests was 1.10 Ruds-ft 2/cu ft; the soiling potential per unit of fuel input was Rud-ft 2/lb. of coal. By expressing soiling potential values per unit of fuel lend, emissions per unit of time can be quantitatively determined by simple arithmetic calculations. Another advantage of the soiling potential method is that the summation of source strengths in the same terms as the measurement of the resulting soiling index provides a ready means for estimating the contribution of various combustion sources to the total buildup of atmospheric particles.

1432 APTIC NUMBER 17322

Gruber, C. W., W. L. Pritchard, and C. E. Schumann
RECOMMENDED STANDARD METHOD FOR MEASURING WIND-BLOWN NUISANCE PARTICLES. J. Air Pollution Control Assoc., 20(3): 161:163, March 1970. 7 refs.

Windblown particulates greater than 20 micron in diameter can be seen without the aid of magnification and account for a major portion of nuisance complaints. The Air Pollution Control Association's method of measuring these particulates in dust fall is described. It consists of exposing a suitable adhesive material wrapped around an atmospheric adhesive impactor. For a continuing survey, the sampler is exposed in the ambient air for about a week, after which the sampler is removed for analysis and replaced by another adhesive impactor. The particulates are evaluated on a device arranged to compare one-eigth of the sample at a time with precounted visual standards. By this method, the eight points of the compass are considered. Results are recorded as '100 particles per sq in., with values ranging from less than 10 to over 600. The real values corresponding to this range are from 100 to 60,000 particles per sq in. per wk. Higher values are unreliable. The adhesive sampler can also be used for locating the sources of nuisance particles by multiple sampling around suspected locations.

1433 APTIC NUMBER 17546

Hanst, Philip L.
INFRARED SPECTROSCOPY AND INFRARED LASERS IN AIR POLLUTION RESEARCH AND MONITORING. Appl. Spectr., 24(2):161-174,

March-April 1970. 24 refs.

Infrared absorption bands have the advantage of presenting a characteristic band structure for nearly all molecules of interest in the air pollution problem, and without the serious interferences and overlapping of the ultraviolet region. Organic peroxy nitrates, discovered by infrared absorption spectroscopy and verified in the Los Angeles atmosphere, have since been shown to be both crop damaging and eye irritating. Any development which will alleviate the problem of beam divergence or increase the energy available from the source will permit significant improvements in pollutant detection, and the laser transcends the limitation of incoherent light by its facility to collimate, fold inside an absorption cell, and produce high contrast in intensity. Carbon dioxide and iodine lasers emit lines which fall within the absorption bands of principle atmospheric pollutants, and each can be operated continuously with a good power output. Modes of operating the laser probe are to use a folded laser beam, reflect it from a retroreflector, and reflect it from natural targets. Lasers have the ability to produce short but powerful optical pulses. Experiments using pulsed lasers almost always depend upon scattering the laser energy by the constituents of the atmosphere, and four types of scattering are reviewed: Rayleigh, Mie, resonance, and Raman. Using incoherent thermal radiation, a nondispersive infrared technique was selected for further development.

1434 APTIC NUMBER 18122

Hariharan, T. A.
AN AIRBORNE POLARIMETER FOR ATMOSPHERIC RADIATION STUDIES. J. Sci. Instr. (J. Phys. E) Ser. 2, 2(1):10-12, Jan. 1969. 6 refs.

A new polarimeter, to measure the Stokes parameters of linearly polarized atmospheric visible radiation in four narrow spectral regions, is described. The instrument was developed for airborne application to measure polarization of reflected solar radiation from various land, sea and cloud surfaces. It consists essentially of a polarization prism assembly of four Glan Thompson prisms oriented so as to transmit light vibrations at 0, 45, 90, and 135 degrees with respect to a chosen direction. A rotating aperture wheel allows the light beams transmitted by the polarizers to reach the cathode of a photomultiplier tube in sequence. The signals from the photomultiplier tube are separated and identified with gate circuits triggered by pulses from magnetic transducers fixed near the polarizing prisms. From simple relations between the output signals the desired Stokes parameters are obtained. The transducer pulses are also passed through delay circuits to give delayed pulses to gate housekeeping data such as spectral region, optical gain, scan angle, etc. The method of measurement and some results obtained during a recent meteorological expedition are presented. (Author's Abstract)

1435 APTIC NUMBER 11866

Hersch, P. and R. Deuringer
GALVANIC-COULOMETRIC MONITORING OF SULFUR DIOXIDE IN AIR. Preprint, American Chemical Society, Washington, D. C., 22p., 1965. 17 refs. (Presented at the American Chemical Society, 149th Annual Meeting, Detroit, Mich. April 8, 1965.)

The technique of galvanic analysis was extended to the continuous monitoring of sulfur dioxide which combines sensitivity with a minimum of circuitry and mechanical elaboration, and is independent of temperature. The cell measures continously about 10 to the minus 8th vol SO2/vol air without reagent feed, calibration, or servo mechanism. The electrolyte is moved around in a loop by the sample air stream. There are three electrodes: anode A, a platinum wire; bipolar electrode B, a bed of active carbon; cathode C, a 'ponytail' of graphite threads. A battery sends a constant current J through the pair AB, generating iodine at A. In the absence of SO2 and other consumers of iodine, all the iodine is reduced back to iodide at C by galvanic action of BC. The galvanic output (i1) then equals the electrolytic input J. In the presence of SO2, part of the iodine is reduced chemically and the galvanic current (i) is smaller. The deviation i1-i from the base line i1 represents coulometrically the flux of the reducing gas. Batch samples of reducents are measurable as negative peaks. Nitrogen dioxide interferes little, NO and SO3 not at all. Ozone can be destroyed catalytically. The cell should be usable where older systems give a continuous signal only at the cost of much electromechanical elaboration. The cell can also monitor oxidants such as ozone or chlorine, in which case the electrolytic circuit can be omitted. (Author abstract modified)

1436 APTIC NUMBER 17524

Himi, Yasuji
METHOD FOR MEASURING DUST AND SMOKE. (baijin sokutei to sono kanrenkini ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(9):581-592, Oct. 15, 1966. 13 refs.

Methods for measuring dust and smoke are classified according to their purpose. To study ways to remove offensive substances by an air cleaner, the dust in the exhaust gas flowing from the source inside the chimney must be measured. Measuring the amount of dust in the atmosphere is very important to establish work surroundings and the degree of atmospheric pollution. Factors to be measured are density, amount of particles, size distribution of particles, and chemical content. Methods for measuring settling particles and smoke, density of atmospheric dust and smoke, and diameter distribution of the particles are reviewed, together with apparatus for measuring dust from the source. The latter include a vacuum pump, gas meter, dust tube, and filter paper. The devices for measuring falling dust include the deposit gauge, dust jar, petri dish, high-volume air sampler, Hoken automatic impactor, single-stage impactor, cascade impactor, and tape air sampler.

1437 APTIC NUMBER 17578

Hinners, Robert G.
LABORATORY PRODUCED AUTOMOBILE EXHAUST FACILITY. Biomed. Sci. Instrum., vol. 1:53-58, 1964. (Proceedings of the First Biomedical Sciences Instrumentation Symposium, June 14-17, 1963, Los Angeles, Calif., Fred Alt, ed.)

A laboratory facility is described which was designed to study the effects of lifetime exposure of experimental animals to auto emissions. An automobile engine is coupled to a dynamometer unit designed to produce exhaust and crankcase blowby according to an established driving pattern. The emissions are proportionally diluted with cleaned conditioned air to simulate atmospheric concentrations and conditions generally found in the air of a city like Los Angeles. This air is fed to four irradiation chambers where sunlight is simulated by three types of fluorescent tubes. The dilution system provides non-irradiated exhaust in a similar time-concentration pattern. A separate line carries cleaned air at the same rate of flow. Four separate sets of conditions are maintained in the chambers; the variables are concentration, rate of flow, and duration, and intensity of light. These atmospheres are monitored with continuous recording instruments on a rotational schedule. Effluents from the four irradiation chambers along with their raw exhaust and cleaned air are ducted to four large tables, each supporting 24 animal exposure chambers. The facility comprises six major physical components: (1) double engine dynamometer unit; (2) air purification unit; (3) irradiation chambers; (4) exhaust dilution system; (5) animal exposure chambers; and (6) monitoring instrumentation. All six components are described in detail.

1438 APTIC NUMBER 17378

Hwang, Jae Y.
DETERMINATION OF ATMOSPHERIC IRON PARTICULATES BY X-RAY FLUORESCENCE SPECTROSCOPY. Talanta, 17(1):118-121, Jan. 1970. 12 refs.

Atmospheric iron particulates as iron oxides present a serious hazard to human beings. They can be determined with satisfactory precision and accuracy by X-ray fluorescence spectroscopy.
Diluted samples of 1000, 300, 100, 30, and 10 micrograms of iron were precipitated as hydrous (III) oxide and the intensities of (FeK(alpha) lines determined. The count-rate was plotted on a log-log scale for amounts between 10 and 1000 micrograms. The recorded peaks of the X-ray fluorescence spectra and the calibration graph are shown. The working curve is linear up to 1000 micrograms of iron as hydrous iron (III), though it is doubtful whether the linearity will hold up to 1000 micrograms in actual atmospheric samples. The precision of the method, while comparing favorably with that of atomic-absorption spectroscopy, could be improved by using a thinner beryllium window in the X-ray chamber. Disadvantages of the method are complications due to inter-element effects and the difficulty in preparing proper standards.

1439 APTIC NUMBER 18092

Iddings, Frank A.
NUCLEAR METHODS IN AIR AND WATER POLLUTION ANALYSIS. Environ. Sci. Technol., 3(2):132-140, Feb. 1969. 15 refs.

Nuclear methods are well suited to the field of pollution analysis. Sensitivities obtainable range from parts per million down to 1000 molecules. The chemical nature of the radioactive material can be controlled and the method can become specific for the substance being determined. Freedom from interferences, simplicity of use, predictability, and low cost are important advantages of the nuclear methods. Detectors described briefly are ionization or gas-filled detectors and scintillators. A number of nuclear techniques are available to the pollution analyst. Isotope dilution, radiorelease, radioisotope derivative analysis, radiometric tracing, radiation absorption, and activation analysis titration, are discussed briefly and examples of application are given.

1440 APTIC NUMBER 17748

Irani, R. R. and E. F. Kaelble
PARTICLE SIZE DISTRIBUTION MEASUREMENTS BELOW FIVE MICRONS. Anal. Chem., 33(9):1168-1170, Aug. 1961. 12 refs.

The centrifugal sedimentation technique and electron microscopy with electronic counting and sizing were compared for the measurement of particle-size distributions of calcium phosphate and silica below 5 microns. Weight-size distributions from the two techniques agreed within experimental error for material whose particle shape does not deviate significantly from sphericity. A precision of 4.4% absolute at 95% confidence limits was obtained for electron microscopy and 4.9% absolute at 95% confidence limits for centrifugal sedimentation. Similar agreement was observed on flour, clay, and glass particles. The microscopic technique consistently gave a coarser particle-size distribution for odd-shaped particles such as rods or plates. As a routine quality control tool, the centrifugal sedimentation technique is more applicable in the size range over 0.5 micron, requiring less expensive equipment and offering more fool-proof operation. When 100% of the particles are below 1 micron, the electron microscopy technique is more practical, requiring only a fraction of the time predetermination needed for centrifugal sedimentation. The centrifugal sedimentation technique cannot be used for materials with particles below 0.1 micron because of excessive time required per determination and inaccuracies due to Brownian movement.

1441 APTIC NUMBER 11691

Jacobson, Jay S.
PERMEATION TUBES AS GASEOUS HYDROGEN FLUORIDE SOURCES. Am. Chem. Soc., Div. Water, Air, Waste Chem., 7(1):232-234, 1967.

The permeation tube technique offers a simple means of obtaining standards for trace gas analyses, since the tubes are calibrated gravimetrically. The constructions of permeation tubes for delivering known amounts of gaseous fluoride at a constant rate is described. Sources of gaseous fluoride, the resistance of tubing to chemical attack by fluorides, and various techniques of sealing tubes are evaluated. Developmental work indicated that permeation tubes can be constructed containing pure, liquid hydrogen fluoride in polyethylene or polypropylene tubing under specified sealing techniques; at present, however no foolproof sealing method is known. The best combination of materials and techniques was used to calibrate tubes gravimetrically under controlled temperatures to determine whether losses in weight were occurring and whether weight losses were relatively constant with time. Repeated weighing of different tubes gave weight losses of 80 to 210 micrograms/hr per tube or 10-14 micrograms/hr per sq cm of diffusing surface for polypropylene tubes and 3-5 micrograms/hr per sq cm of diffusing surface for polypropylene tubes. A third phase of the work still in progress, involves determining whether the reductions in weight are a direct and exact measure of permeation of gaseous fluoride. The future value of permeation tubes as standards for atmospheric fluoride measurements appears to depend on the reduction of variability and on establishing the constancy of permeation over long time intervals.

1442 APTIC NUMBER 18119

Kats, Gerrit and G. Ray Thompson
NOTE ON A SIMPLE DEVICE FOR MAINTAINING LIQUID LEVELS IN GREENBERG-SMITH IMPINGERS. J. Air Pollution Control Assoc., 19(4):265, April 1969.

A simple device for automatically maintaining a safe liquid level in Greenberg Smith impingers is described. The basic idea was to use the weight of the impinger with liquid and a pressure sensitive device to maintain this weight by controlling a liquid flow to the impinger. The equipment consisted of a regular household scale equipped with an adapter to hold the impinger, a calibrating screw, and a cam under the platform to relay pressure changes to a piece of soft, resilient rubber tubing connected to a water reservoir. As evaporation takes place, the weight loss causes the cam to lift and liquid will flow by gravity through the tubing entering the impinger at the top until equilibrium is reached.

1443 APTIC NUMBER 17522

Kawai, T.
MEASUREMENT OF SULFUR OXIDES IN EXHAUST GASES. 5. BARIUM CHLORANILATE METHOD. (Haijasuchu no iosankabutsu sokuteiho. 5. Kuroranirusan baryumu ho). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 22(2):20-23, Feb. 28, 1970.

A method for determining the sulfur oxides content of exhaust gases entails absorption of the oxides in a 3% hydrogen peroxide solution to which ethyl alcohol and barium chloranilate are added. The density of the total oxides is then obtained from spectrometric or photometric measurements of the amount of light absorbed by the solution. The method is suitable for analyzing from 200 to 2000 ppm of total sulfur oxides in the exhaust. The chloranilate dissolves in water, turning it a purple-red. Barium chloranilate is a dark purple crystal not readily dissolved in water. In water containing sulfur ions, however, sulfur barium precipitates, freeing water-soluble acid chloranilate ions which effect the color change. As this reaction proceeds quantitatively, the quantity of sulfur ions can be measured by the degree of light absorption in the solution. The purple-red water solution is transferred to a glass cell, which is radiated by monochromatic light. The light is absorbed in the solution and weakened according to Lambert-Beer law. Light brown barium chloranilate crystals should not be used. Factors affecting the accuracy of the method are discussed.

1444 APTIC NUMBER 17494

Kelenffy, Szilveszter
PHOTOELECTRIC DETERMINATION OF ATMOSPHERIC SO2. (Kendioxid meghatarozasa atmoszferas levegobol fenyelektromos kolorimetriaval). Text in Hungarian. Egeszsegtudomany, 10(3):282-285, 1966. 3 refs.

A photoelectric device for determining sulfur dioxide is described which consists of a photometer, a special gas-absorber, and a light source. A 0.00005 M starch iodine solution is applied as absorbing fluid. With the aid of the calibration curve, the SO2 content of the atmosphere can be determined. A single determination usually requires 10 to 50 l of sample. The detection threshold of the method is 2 microgram SO2. Its error margin is plue or minus 10% at an SO2 concentration of 10 micrograms in the sample.

1445 APTIC NUMBER 17855

Kettner, Helmut
THE PROBLEM OF OBJECTIVE SOOT DETERMINATION IN DUST PRECIPITATIONS. (Zur Frage der Objektivierung des Russbestimmung in Staubnieder-schlaegen). Text in German. Gesundh. Ing., 91(3): 84-86, 1970.

The soot determination method, based on a comparison of the grey tone left on a glass fiber with a calibration curve obtained with artificial soot, was not suitable for analysis of atmospheric soot. Atmospheric soot presumably changes its properties, together with the surface of the soot, through repeated treatment with acids and lye. The purest atmospheric soot which could be obtained by this method contained 90% carbon and was grey. Thus, the possibility of objective soot determination by this method remains limited. More objective than this comparative method is the use of a calibration curve obtained from the natural dust fall. Multiple volumes of the sample are plotted on the ordinate the respective grey or black tones on the abscissa. For evaluation, soot annoyance indices are used. Preliminary results from soot determinations by this method yielded soot annoyance indices up to 0.5 for rural areas and between 2.0 and 3.0 for industrial areas.

1446 APTIC NUMBER 17474

Kolar, Joergen
THE ELECTROSTATIC DUST MEASURING DEVICE 'KONITEST' AND ITS FUNCTIONING IN A REMOTE HEATING PLANT. (Das elektrostatische Staubmessgeraet 'Konitest' bei betriebsmaessigem Einsatz in einem Heizkraftwerk). Text in German. Tech. Ueberwach (Duesseldorf), 10(6):188-190, June 1969. 6 refs.

Control measurements were taken on an electrostatic dust measuring unit operation in a remote heating plant. The measurement probe had been installed in the stack 11 m above the exhaust blower. The speed in the probe was 1.5 times as high as the flue gas speed. The konitest and the dust filter were connected to the electrically heated sampling tube. A rubber hose lead to the blower. For weighing the dust quantity, a scale with an accuracy of at least 0.1 mp was used. The results of the measurements varied widely. In order to find an explanation for this, a steel pipe with a 12 mm diameter was inserted into the flue gas duct. The charges caused by the dust on the steel pipe were measured. The varying electric charges of the fly dust leaving the electrostatic precipitator caused the great divergence in the measured values.

1447 APTIC NUMBER 17856

Lahmann, Erdwin and Karl-Ernst Prescher
METHODS FOR AUTOMATIC AIR MONITORING. (Methoden zur automatischen Luftuntersuchung). Text in German. Gesundh. Ingr., 91(1):21-24, Jan. 10, 1970. 24 refs.

Sampling and measuring methods for air pollutants used in Germany are described. Gaseous pollutants are mostly adsorbed in liquids. Adsorption on silica gel or direct measurment with an infrared analyzer is less frequently used. Dusts are mostly sampled by filters. Sampling can be done automatically in almost all cases. Sulfur dioxide content is measured by electroconductivity analyzers. Carbon monoxide is measured in the gaseous phase by absorption of infrared rays at wave lengths between 2 and 15 micron. Hydrocarbons are continuously and automatically measured by a flame ionization detector. For the continuous measurement of ozone, an instrument was developed in Germany which determines electrochemically the bromine liberated by the ozone passed through a potassium bromide solution. Photometers permit simultaneous continuous measurement of several pollutants. Graphical plotters are mostly used for recording the measured data. As an example, the automatic air monitoring system operating in Berlin since August 1968 is described. At six stations, SO_2 concentrations are measured. The data are transmitted to a central station where they are recorded.

1448 APTIC NUMBER 17544

Lang, Helen W., W. E. O'Neill, B. A. Coulehan, and R. W. Freedman
CONTINUOUS MONITORING OF DIESEL EXHAUST. Instr. Control Systems, 43(4):127-130, April 1970. 12 refs.

An apparatus was constructed which combines nondispersive infrared analyzers, polarographic oxygen analyzers, and mass spectrometry; it is estimated that this continuous sampling equipment reduces analysis time by a factor of two. Carbon dioxide, carbon monoxide, and methane, which show strong absorption, were investigated by infrared analyzers. Partial pressure of oxygen was measured proportional to anode-cathode current flow, and a mass spectrometer was used for nitric oxide determination. Three infrared analyzers for CO_2, CO, and CH_4 and the oxygen analyzer were mounted on a mobile cart with inlets and outlets arranged in series. The mass spectrometer was mounted parallel, and a three-eighths-inch stainless steel sample introduction line was used for all the continuous analyzers. Frequent draining and packing replacement were required for the first in-line trap, and an antifreeze bath trapped most of the moisture remaining in the sample. Filters were used to trap fine particulate matter, and an air pump extracted exhaust from the final filter. Gas then flowed to a tee where it split between a vent line and flowmeter for calibration. Infrared and oxygen analyzers were checked by independent gas volumetric and chromatographic analyses, while nitric oxide determinations were compared to results from Saltzman and phenoldisulfonic analyses.

1449 APTIC NUMBER 17452

Lauer, O.
NEW CENTRIFUGAL LABORATORY WIND SIFTER WITH LARGE SEPARATION RANGE. (Neuer Fliehkraft-Laborwindsichter mit weitem Trennbereich). Text in German. Chem. Ing. Tech., 41(8):491-496, April 1969. 2 refs.

A centrifugal wind sifter wind rotating zig-zag channels was developed for grain size analyses. It can be used for grain sizes from 1.5 to 8.0 micron and for materials with a density of 2.7. The unit has throughput of 0.5 to 3 kg/hr. The sifting process comprises of dosing - dispersing and separating the fine and coarse material from the carrier gas. The material which is to be sifted is filled into a wide-necked bottle which is tightly attached to the charging device. The latter consists of a screw conveyer and an agitator. A blower injects about 55 to 60 standard cu m air/hr. The desired sifting range can be adjusted by varying the rpm of the sifting wheel and the air quantity according to a calibration curve. The discriminating effect of the wind sifter and the reproducibility are good. Even material with a strong tendency to agglomerate can be separated.

1450 APTIC NUMBER 12000

Legate, C. E.
A FAST RESPONSE FLAME IONIZATION DETECTOR FOR EXHAUST HYDROCARBONS. Preprint, Shell Oil Co., New York, 6p., 1966 (?). 1 ref.

A hydrocarbon flame ionization detector with a specially designed sample inlet system is described; continuous and accurate monitoring the of the total hydrocarbon content of exhaust gases from a cyclically operating engine is possible. The two-stage sample introduction system gives the detector a fast response by providing a short delay time with accurate control of exhaust sample to the detector flame. Gas sampling techniques are important in obtaining reliable results; it is preferable to locate the sampling point after a muffler or exhaust snubber system, and the sample line should be as short as possible to minimize sample gas transit time. It is also essential that condensation of water vapor in the sample introduction system be prevented. The magnitude of oxygen interference with the hydrocarbon measurements depends both on oxygen concentration in the sample and hydrocarbon composition of the sample. Significant errors are encountered in samples containing greater than about 3-4% volume oxygen, such as exhaust gas diluted with air. Optimization of the air/hydrocarbon and hydrogen/sample ratios is employed to control this effect, and although it is not completely eliminated, errors can be reduced to levels which are acceptabe in view of the other variables affecting measurement of exhaust hydrocarbons.

1451 APTIC NUMBER 12184

Lieberman, A.
AUTOMATIC AND REMOTE MONITORING SYSTEMS FOR AIRBORNE PARTICLES.
Atomic Energy Commission, Washington, D. C. and National
Aeronautics and Space Administration, Washington, D. C.,
Contamination Control: Current and Advanced Concepts in
Instrumentation and Automation, p. 198-217, 1967. (AEC/NASA
Symposium, Sept. 12-14, Albuquerque, N. Mex.)
CFSTI: SC-M-68-94

Two particle counting systems based on light scattering are described. The first system consists of three light scattering air handling systems whose outputs are multiplexed into a single data center. Particles between 0.5 micron and more than 100 micron in air are simultaneous monitored in three separate locations. By using a variable viewing volume controlled viewing zone principle, it is possible to vary the actual gas volume analyzed from .0076 cu ft/min to 0.42 cu ft/min. The electronic system consists of a pulse height analyzer which measures the size of the pulses produced as each particle passes through the viewing zone. The data system accepts particle count data from the three samplers, transmits the count data by wire to the data center, enters it into a memory unit, and makes a periodic printout of the accumulated particle totals. The second particle counter developed samples isokinetically and remotely for particles in the size range of 1/2 micron to 500 micron and over. This system produces data that can be used to show real time particle size distribution and concentration at 1 or more points in a test grid. A transducer system employing single particle counting by light scattering is used. Two sensors, one for particles 1/2 micron to 32 micron, and one for particles 16 micron to 500 micron are used to detect aerosols. Automatically controlled isokinetic sampling is used for the first sensor. The inlet speed is varied. The sampling device for the second sensor samples at constant inlet gas velocity. A remote control unit is used to operate the field sensors. The pulse height analyzers in the two sensors transfer the data to eight channels of binary coded digital data for transmission to the data center.

1452 APTIC NUMBER 12132

Lodge, James P., Jr.
DETERMINATION OF NITROGEN OXIDES. Preprint, Robert A. Taft
Sanitary Engineering Center, Cincinnatic, Ohio, Lab of Engineering
and Physical Sciences, 4p., 1960. 3 refs.

The Saltzman and Jacobs techniques for field determinations of nitrogen oxides are compared. The Public Health Service study of automotive exhaust uses the Saltzman reagent for both nitrogen dioxide and nitric oxide. The latter is oxidized by passage through 2.5% potassium permanganate in 2.5 (w/v) % aqueous sulfuric acid. The Saltzman reagent will keep for some months in a dark, refrigerated bottle. It will, however, last only a few days in light at room temperature. It has a substantial temperature coefficient for color development; for accurate work, it must be used at room temperature, and always measured the same length of time after sampling. Because of the reagent's lability and the developed color, the National Air Sampling Network uses the Jacobs procedure. They sample for 24-hours into alkali, then ship the sample to a central laboratory for analysis. The delay in analysis may be as great as three weeks, but replicate samples always agree closely. Though no studies are known of nitric oxide determination by this method, there is no reason why it could not be used in a manner analogous to the Saltzman method. The choice between the two methods appears to be entirely that of convenience in the particular application.

1453 APTIC NUMBER 18116

Lundgren, D. A. and D. W. Cooper
EFFECT OF HUMIDITY ON LIGHT-SCATTERING METHODS OF MEASURING
PARTICLE CONCENTRATION. J. Air Pollution Control Assoc., 19(4):
243-247, April 1969. 7 refs.

An experimental investigation was undertaken to isolate and quantitatively determine the effect relative humidity has on the light-scattering ability of aerosols. Both the naturally occurring ambient aerosol of State College, Pa., and several common test aerosols were used. A measured flow of aerosol was mixed with a measured flow of particle-free air to form a mixture of constant contaminant level; the humidity of this mixture was varied by controlling the moisture content of the clean diluent air. The total light scattered by a given aerosol sample, at various relative humidities, was measured with a Sinclair-Phoenix aerosol photometer (measures the total light scattered in the near forward direction). All measurements were carried out at atmospheric pressure, and after the particulates had an average of 1-1/2 minutes to reach equilibrium with the water vapor. Natural and laboratory-generated aerosols were both tested in this manner. (Author's Abstract)

1454 APTIC NUMBER 18115

Lynam, D. R., J. O. Pierce, and J. Cholak
CALIBRATION OF THE HIGH-VOLUME AIR SAMPLER. Am. Ind. Hyg. Assoc.
J., 30(1):83-88, Jan.-Feb. 1969. 6 refs.

The use of either a variable voltage transformer (Variac) for regulating the fan speed or resistances has been widely accepted for varying the air flow through a high-volume sampler during calibration. Calibration data for the Stapler high-volume sampler demonstrate that significant differences exist between the calibration results obtained by the two methods. Calibration curves obtained with a bellows-type dry gas meter and a rotating vane anemometer clearly illustrate that resistances should be used as the standard procedure for varying the flow rate during calibration of the Staplex high-volume sampler. A simplified calibration procedure utilizing a rotating vane anemometer at the sampler inlet is described. (Author's Abstract)

1455 APTIC NUMBER 17770

Mammarella, L.
SAMPLING OF AIRBORNE BACTERIA BY MEANS OF A CASCADE VAULT SAMPLER. (Il prelievo di batteri aerogeni mediante un campionatore a volta in cascata). Text in Italian. Riv. Med. Aeron. Spaziale, vol. 28:313-326, July-Sept. 1965. 5 refs.

A simple device is described for sampling bacteria aerosols in which the individual particles are about 10 micron in size or larger. It consists of (1) a cylindrical base into which a Petri dish containing a solid culture medium can be inserted and (2) a cover unit with a series of 3 'steps' arranged at right angles to the direction of the airstream, each step being higher than the last. The base contains two holes, one for the entrance of air and another, at a higher level and diametrically opposite, through which the air escapes. As the airstream contacts the vertical walls of the step structure, a certain amount of the material suspended in the air will fall onto the surface below, which contains a solid culture medium. The sampler, which has performed well in comparative tests, is recommended for use in conjunction with the perforated-disk sampler, its special usefulness being in the detection of large but still inhalable particles that are partly responsible for spreading infection.

1456 APTIC NUMBER 16579

Ministry of Technology, Stevenage, Herts, Warren Spring Lab.
GRIT AND DUST. Air Pollution Notes, Sept. 1967. 4p. 1 ref.

Procedures are outlined for collecting grit and dust samples in short-term surveys. Because these surveys can be confined to days when the wind is in a given direction, they are more effective than monthly collections in identifying the source of a nuisance. The use of a dust gauge in the form of a tall cylinder or large plastic bowls is recommended to collect sufficient material. Three or five collectors should be distributed about 100 m apart, one where the nuisance has occurred and one or two on either side at right angles to the wind direction from the suspected source. For good exposure, the distance of a bowl from nearby objects or buildings should be at least twice the height of the object or building above the bowl. After being brushed into glass containers, collected samples should be weighed on a chemical balance capable of measuring to 0.1 mg and examined microscopically. In many cases, a second test carried out under another wind direction at least 60 deg from the original is necessary to locate the source.

1457 APTIC NUMBER 12194

Moffat, A. J.
RESULTS OF AIRBORNE SURVEY OF NO_2 AND SO_2 OVER LOS ANGELES BASIN. Barringer Research Ltd., Rexdale (Ontario), Contract NAS9-7958, TR-68-68, 129p., Sept. 1968.

An airborne survey of atmospheric nitrogen dioxide and sulfur dioxide was performed over the Los Angeles basin comprising Los Angeles and Riverside Counties. The purpose of the survey was to evaluate the Barringer correlation spectrometer as a tool for measuring concentrations of atmospheric contaminants. This report describes the airborne measurement procedures, the flight lines or survey patterns flown, the meteorological conditions at the time of flight, the method of data reduction, and the end results obtained. These results are compared with simultaneous ground-based measurements. The procedure followed during each flight was to obtain a vertical temperature profile of the atmosphere by monitoring ambient air temperature at regular intervals during a spiral ascent over Riverside Airport. The operational altitude was then chosen on the basis of temperature inversions indicated by the data. Before commencing a data run, a spectrometer calibration was performed. This consisted of zeroing the spectrometer output against the overhead sky and recording the response obtained. A similar calibration was performed frequently during a mission and at the end of each flight. At the completion of the mission, temperatures were again measured at regular intervals during the descent. These temperature profiles, together with barometric ground pressure readings were used to reduce the spectrometer strip chart recordings to average pollution concentrations. The flights demonstrated the suitability of the spectrometer for a survey of the distribution of total atmospheric pollution of NO_2 or SO_2 and for the measurement of atmospheric diffusion parameters. The correlation between NO_2 measured in the air and on the ground was good.

1458 APTIC NUMBER 17773

Moore, George Evan, J. L. Monkman, and Morris Katz
SOME PROBLEMS CONCERNING ANALYSIS OF POLYCYCLIC HYDROCARBONS IN PARTICULATE POLLUTION SAMPLES. Nat. Cancer Inst. Monograph, no. 9:153-169, 1962. 21 refs.

The concentration levels of polyclic hydrocarbons in the atmosphere, especially in North America, are so low that they are on the order of micrograms per 100 cubic meters of air. Their identification and analysis thus requires high accuracy and standardized results. An international carcinogenic 'index' would be highly desirable. Although air pollution problems in Canada are generally less acute than in England and the United States, eight or more polycylics have been found in urban atmospheres, and quantitative estimates have been made of pyrene, fluoranthene, benzo(a)pyrene, and coronene. Among the specific problems in present-day methods of determination are the volatility of polynuclear substances; incomplete resolution on columns; degradation upon exposure to ultraviolet radiation; difficulties in interpretation; sampling problems; influence of solvent on fluorescence; the ambiguity of fluorescent intensity measurements the nonreproductibility of

RF values in paper chromotography; the contamination and irregularity of acetylated paper; and the unsatisfactory purity of reference standards. Sulfur dioxide is a much more potent inhibitor of fluorescence than oxygen. The fluorescence of benzo(a)pyrene is completely and reversibly inhibited in concentrations of 10 micrograms per ml when the solvent is saturated with SO_2 at 740 millimicrons. Present procedures for the manufacture of acetylated paper seem to involve acetylation after the sheet has been made, so that there are signs of rinse marks and gross contamination, causing yellow or orange fluorescence. The present instrumentation for gas chromatography is not well designed, especially in the area of injection and rapid vaporization of samples, as well as the introduction of solid samples. Detector cells tend to present difficulties in cleaning, and there are usually too many bends in the connections, conducive to local condensation and loss. A promising approach is the use of very low concentrations of a stationary phase in glass bead support.

1459 APTIC NUMBER 12334

Morgan, George B., Jack C. Fensterstock, and Thomas B. McMullen
THE DETERMINATION OF ATMOSPHERIC FLUORIDES USING THE FLUORIDE ION ELECTRODE. Preprint, American Society for Testing and Materials, Philadelphia, Pa., 23p., 1968. 6 refs. (Presented at the Conference on Air Quality, Plainfield, Vt., 1968.)

The application of a fluoride-selective electrode as a new analytical tool for measuring the concentration of fluorides in ambient air is described. This electrode consists of a laser-type, single-crystal membrane of europium-doped lathanum fluoride, which is highly specific for the fluoride ion. When used in conjunction with a calomel reference electrode, it gives a Nernstian response over a concentration range of more than four orders of magnitude. The electrode is very useful in easily and rapidly measuring atmospheric fluorides collected on glass fiber filters. This is of extreme importance, as this instrument can then be applied to the samples routinely collected by the National Air Surveillance Networks (NASN) or similar surveillance agencies. Virtually all of the fluoride that is collected on both glass fiber filters and membrane filters is water soluble, indicating that this method can replace the slow and tedious colorimetric procedures. Another important factor is that all the fluoride collected on glass fiber filters is biologically active. The electrode is stable and quite reproducible. Sensitivity of the electrode is comparable to that of SPDNS method. The fluoride ion activity measured in aqueous extracts of atmospheric particulates was directly related to the total fluoride concentration in the atmosphere. Using the electrode technique, the fluoride concentration at NASN sites (both urban and nonurban) during the 1966 sampling year were surveyed. Data are presented for samples collected at 150 stations over a 12-month period. A cursory examination of the data shows a possible relationship between certain sources and observed fluoride levels. (Author abstract modified)

1460 APTIC NUMBER 12146

Nader, John S. and William L. Coffey
DIRECT DIGITAL RECORDING OF AIR POLLUTION MEASUREMENTS. Preprint. Air Pollution Control Association, New York City, 12p., 1961. 1 ref. (Presented at the Air Pollution Control Association, Annual Meeting, 54th, New York, June 13, 1961, Paper 61-5.)

A modification of a commercially available punch tape recorder was presented, in which analog information is converted directly into digital data (binary-decimal code) on punched paper tape. The prototype was designed to give 3 digit full scale output (000-999) for full scale signals as low as 10 mv and as high as 100 mv. It is provided with span and zero adjustments and electrical overtravel at both ends of the range. Accuracy is within approximately 0.1% or 50 microvolts, whichever is greater. Response is linear and the full range (000 to 999) response is approximately 3.5 seconds. Reproducibility is within approximately 0.05% of the full scale. Additional results of a performance evaluation were given and application of the instrument to air pollution measurements was discussed. As an electrical analog-to-digital converter, the recorder can be coupled to any sensing or analytical device which has an electrical signal output. Preliminary application for direct digital tape punching of analog signals was made to a light scatter photometer. This device detects suspended particulates in the air by right-angle light scatter and gives a reading in terms of a calibrated electrical response which appears on both an indicating meter andd a strip-chart recorder. (Author abstract modified)

1461 APTIC NUMBER 17511

Nagao, Fujio, Yuzuru Shimamoto, Kazuie Nishiwaki, and Hajime Otaka
MEASURING ERROR OF EXHAUST SMOKE DENSITY DUE TO THE VARIATIONS OF PRESSURE AND SMOKE DENSITY. Bull. JSME (Japan Soc. Mech. Engrs.), 13(55):105-111, 1970. 9 refs.

Results obtained on a two-stroke single cylinder diesel engine confirm that the Bosch smoke density varies with the sampling position along the exhaust pipe, and data are given on a smoke content-time and pressure variation measured directly with a light absorption smokemeter. As the measuring point becomes more distant from the exhaust valve, the gas temperature decreases, accompanied with a periodic variation on account of heat loss; since the stagnation period is presumably longer than the flowing period, the temperature measured does not indicate the spatial average temperature of the exhaust gas. The large fluctuation in smoke density may be explained by the difference in phase correlation between the pressure and smoke content variations at different sampling points or again the pulsating flow of exhaust gas. Minimum points of the exhaust gas temperature curve almost coincide with those of the Bosch smoke density variation and stagnation periods.

1462 APTIC NUMBER 17520

Nakamura, Keijo
SO_2 MEASUREMENT IN THE ATMOSPHERE. 1. PARAROSANILINE (WEST

GAEKE) METHOD. (Taikichu no SO_2 sokuteiho. 1. Pararozanirin ho). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 22(2):55-59, Feb. 28, 1970. 7 refs.

The pararosaniline method is standard for the quantitative analysis of sulfur dioxide. The absorber of a very small amount of harmful gaseous substance must have complete absorption ability and sufficient stability. Sodium tetrachloromercurate meets these conditions when pararosaniline and formaldehyde are added to sodium tetrachloromercurate containing absorbed sulfur dioxide, a purplish red pararosaniline-methyl-sulfonic acid is generated. The degree of coloration corresponds to the amount of sulfur dioxide and is measured by an optical absorption method. Atmospheric samples must be collected at points outside the pollution source and the sample collector must have a suction pump and gas meter. The absorbancy meter should measure near 560 millimicrons. The absorption solution is made from 27.2 g mercuric chloride, 11.7 g sodium chloride, 50 g glycerine, and 0.3 g sodium azid; these are dissolved in water to make a total volume of 1 l. The color former, pararosaniline formaldehyde, is made of equivalent volumes of pararosaniline and formaldehyde solution. The sulfur dioxide standard solution is made from sodium hydrogen sulfite and is compensated by titration with 0.1 N sodium thiosulfate and 0.1 N iodine solution. Collection rates depend on shapes and sizes of the absorption tube; if possible, the same structure should be used at all sampling sites. The quantity of sulfur dioxide depends on the length and diameter of the conduction tubes, flow velocity of sample gas, humidity, etc.

1463 APTIC NUMBER 17543

Nanbu, Toichi
POINTS AT ISSUE IN ENVIRONMENT SURVEILLANCE, AND THE FUTURE PROBLEMS. (Kankyo kanshi no mondaiten to kongo no kadai). Text in Japanese. Doboku Gakkaishi (J. Japan Soc. Civil Engrs.), 55(2):75-78, Feb. 15, 1970.

Air and water pollution endanger human health, but methods of monitoring and measuring pollutants are inadequate. Improved detection methods are urgently needed. With regard to air pollution in industrial areas like Tokyo, Yokohama, Osaka, and Yokkaichi telemetric monitoring methods are now employed to process pollutant data rapidly and accurately. On the other hand, monitoring water quality presents many technical problems because of the diversity of contaminants involved; in practice, separate analyzer are conducted for each pollutant. However, automatic measuring apparatus for tests of the water quality are being developed, so it is becoming possible to automate very complex systems. Lack of funds and the unavailability of long-range experimental data are currently the problems in application of these automatic devices. Detection of poisonous microorganisms before they cause damage also requires improved chemical and biological identification techniques.

1464 APTIC NUMBER 17532

Noll, Kenneth E.
A ROTARY INERTIAL IMPACTOR FOR SAMPLING GIANT PARTICLES IN THE ATMOSPHERE. Atmos. Environ., vol. 4:9-19, 1970. 10 refs.

A portable, 16-stage impactor was designed to collect a wide range of giant particles present in the atmosphere. To enable the sampler to operate at wind velocities considerably higher than average wind speeds and in the ambient air, each stage consists of a rectangular collector rotating at a selected speed. Collection is by impingement. Combinations of collector widths and rotor arm lengths provide equivalent efficiencies on different stages for particle diameters between 10 and 100 micron. With an instrument of this type, atmospheric wind speed variations become small, relative to the speed of rotation of a collector. A high velocity of rotation also provides a large flow rate which is required because of the low concentration of giant particles. This eliminates errors in counting due to the excessive covering of the collector surface by numerous small particles. A relative calibration is possible by comparing the particles collected on different stages. The design evaluation of the collector showed that minimum collection efficiencies of 85-100% on each stage were associated with the Stokes number near 10. Each stage has to be operated only in the optimum performance range where collection efficiencies are high and deposited particles are uniformly distributed.

1465 APTIC NUMBER 11683

Norman, V. and R. R. Vinson
NITRIC OXIDE-NITROGEN DIOXIDE ANALYSIS OF TOBACCO SMOKE. Preprint, Liggett and Myers Tobacco Co., Durham, N. C., Research Dept., 12p., 1967. 9 refs. (Presented at Tobacco Chemistry Research Conference, 21st, Durham, N. C. Oct. 19-20, 1967.)

The Griess-Ilosvay colorimetric procedure is the most common method for analyzing relatively low nitric oxide and nitrogen dioxide concentrations in mixture of gases; a study is described for estimating the amount of interference caused in the method by the gas phase of smoke of various types of cigarettes. The investigation was made with 85 mm bright tobacco cigarettes having (a) no filter; (b) a 20 mm cellulose acetate filter of 7.0 cm H_2O pressure drop; and (c) a combined 20 mm cellulose acetate-activated carbon filter of 7.0 cm H_2O pressure drop containing about 100 mg (dry) of granular activated carbon. Results indicate that a considerable part of the nitrogen oxides is not detected by the Saltzmann colorimetric procedure in the presence of other smoke constituents. The amount detected depends on the type of filter on the cigarette generating the smoke. Interference appears to be related to the amount of other vapor phase constituents in smoke. In examining the effect of some of the potential interfering vapors, acetaldehyde, isoprene, and hydrogen sulfide were shown to contribute significantly to the observed interference with nitric oxide. Thus, the total amount of $NO-NO_2$ detected with the Saltzmann reagent is usually considerably less than that determined by procedures such as the oxidation of all $NO-NO_2$ to $NO_3(-)$. The cigarette smoke vapor phase should be submitted to a prepurification step to remove interfering materials before a Griess-Ilosvay type colorimetric analysis can be meaningfully used.

1466 APTIC NUMBER 17534

O'Donnell, Hugh, T. L. Montgomery, and M. Corn
ROUTINE ASSESSMENT OF THE PARTICLE SIZE-WEIGHT DISTRIBUTION OF URBAN AEROSOLS. Atmos. Environ., vol. 4:1-7, 1970. 14 refs.

A method of measuring the aerodynamic particle size-weight distribution of atmospheric particulates is described. The method should prove valuable where rugged instruments and simple sampling procedures are required. A six-stage Andersen impactor is mounted with a cover that simulates the aerodynamic entry conditions of the high-volume sampler used in the National Air Sampling Network. An 0.47 micron pore size membrane filter used downstream of the sampler retains all particles too small to be collected by the sampler. Flow through the impactor is regulated by a critical flow orifice placed between the impactor and back-up filter, while the efficiency needed for continuous sampling is provided by a vacuum pump. The sampler, orifice, and membrane filter combine to form a single unit which can be mounted to a common base plate for ease in handling. With the vacuum pump housed in a wooden shelter, the system maintains a constant flow rate (1 cfm) over a 24-hr period. The weight distribution of an aerosol as a function of aerodynamic equivalent particle size is determined by weighing the amount of material collected on each impaction plate and the back-up filter. This information is essential for predicting pulmonary responses to air pollutants.

1467 APTIC NUMBER 17754

Oxholm, M., Ulf Persmark, and Bengt Foregard
CONTROL OF 'LAUGHING GAS' COMPOSITION WITH GAS CHROMATOGRAPHY. (Gaskromatografisk kontroll av lustgasinblandningar). Text in Swedish. Lakartidningen, 63(7):638-640, Feb. 1966.

A fast and especially reliable method of analyzing gas mixtures is described, with special emphasis on nitrous oxide, but applicable to routine test analyses of mixtures containing various gases. It was developed to provide a way of analyzing gases from the central gas supply that is a part of the newly built hospital facilities. With no special equipment other than a gas chromotograph equipped with a molecular-sieve column, one can isolate and analyze the amounts of hydrogen, nitrogen, oxygen, carbon dioxide, and methane contained in gas mixtures, as well as certain other gases trapped by the column. By successively increasing the temperature (through temperature programming at 5 C/min), the various gases are eluted. An approximate quantitative evaluation is obtained by calculating the areas beneath the respective peaks on the graph. The analyzing instrument is a Wilkens Aerograph 1520 with a single stainless steel column 6 ft by 1/4 in. and a 5 A molecular sieve. Helium can be used as carrier gas, with a flow volume of 70 ml/min.

1468 APTIC NUMBER 17436

Pleschka, K., W. Usinger, and C. Albers
THE DETERMINATION OF THE NITROUS OXIDE CONCENTRATION IN BLOOD AND LIQUOR WITH THE AID OF GAS CHROMATOGRAPHY. (Ueber die Bestimmung der Stickoxydul-Konzentration im Blut und Liquor mit Hilfe der Gaschromatographie). Text in German. Anaethesist, vol. 15-16:166-168, 1966-67. 8 refs.

A method for determining the nitrous oxide concentrations in small blood samples (0.1 to 0.5 ml) by gas chromatography is described. The method combines the vacuum extraction by van Slyke with the sample dispatcher, a four-way cock, by Farhi et al. The reproduceability of the method is better than 0.5%. The method was used for estimating cerebral blood flow and for determining the uptake of nitrous oxide by the cerebro-spinal fluid. Five dogs were anesthetized and the N2O concentration in the arterial blood as well as in the blood of the sinus sagittalis was determined. For an average arterial CO2 tension of 56 torr, the average cerebral blood flow was 46.8 ml/min/100 g and the oxygen consumption of the cerebrum was 3.2 ml/min/100 g. The uptake of N2O by the cerebro-spinal fluid was much slower than in the venous blood.

1469 APTIC NUMBER 17492

Pretorius, Rene and Richard E. Wainerdi
NUCLEAR ACTIVATION ANALYSIS FOR ULTRA-SENSITIVE DETERMINATIONS OF ENVIRONMENTAL POLLUTANTS. S. African Med. J. (Capetown), 1970:169-171, Feb. 14, 1970. 37 refs.

Nuclear activation analysis has become an important tool for measuring prompt particles or gamma-ray photons emitted during nuclear irradiation, and identifying the amount of stable nuclides present in a sample. The nuclear particles most commonly used for activation analysis are neutrons from a nuclear reactor. The method is often nondestructive and lends itself readily to computerization and automation, thus enabling many samples to be analyzed within short periods. Thermal neutron activation analysis has been applied to many air pollution studies because the sensitivity of analysis is such that elements, with the exception of sulfur and lead, can be determined in the ppb concentration range. Charged particle activation is suggested for sulfur and lead determinations. In environmental pollution studies, it is necessary to determine sensitivities in typical pollution samples, since interference from other activities can be serious. When interference is a problem, a chemical separation is carried out after nuclear activation. Activation analysis also appears promising for determining the baseline levels of trace elements in normal and diseased human tissues. Sensitivity limits are presented for samples irradiated for one month, or to a saturation level of induced activity in a nuclear reactor with a thermal neutron flux of 10(13) neutrons/sq cm/sec.

1470 APTIC NUMBER 12225

Raynor, Gilbert S. and Maynard E. Smith
A DIFFUSION-DEPOSITION TRACER SYSTEM. Brookhaven National Lab., Upton, N. Y., BNL 859 (T-343), 17p., April 1964. 6 refs.

A dual tracer technique is described for use in experiments in low-level atmospheric dispersion and deposition. The system is considered unique in two respects. First, it permits definition of the airborne concentrations of a cloud of small particles representative of a true aerosol and simultaneously the deposition of larger particles on the soil and vegetation beneath. Second, the deposition tracer consisting of irradiated Cu(64) particles in the 1- to 10-micron range can be detected directly on the surface without the intervention of any artificial collecting mechanism or the necessity of inferring deposition by mass balance techniques. Uranine dye was used as the diffusion tracer. Data obtained from field experiments include air concentrations of copper particles and uranine at three heights and deposition per unit area measured both by mobile radiation counter and by the sticky paper method. Techniques, instruments, and facilities for the preparation, activation, emission, sampling, and measurement of both tracers are described in sufficient detail to permit reproduction. The report is also intended as a background reference for future analytical studies resulting from field experiments. (Author abstract modified)

1471 APTIC NUMBER 17512

Record, R. G. H.
ATMOSPHERE MONITORING BY MEANS OF A ZIRCONIA SOLID ELECTROLYTE GALVANIC CELL. Instr. Pract. (London), vol. 24:161-167, March 1970. 10 refs. (Presented at the 4th Industrial Process Heating Conference, Manchester, 1969.)

A new approach to industrial O2 measurement in hot gases, and in particular to inert gas monitoring, has become possible using a zirconia solid electrolyte oxygen probe. If the condition of pure ionic conduction within the solid electrolyte is fulfilled, then a potential difference will be set up between the two electrodes, dependent upon the ratio of the oxygen partial pressures; provided the oxygen partial pressure is known at one electrode, a measurement of this potential difference will enable the oxygen partial pressure at the other electrode to be determined. Measurement can be carried out in a hot environment without the use of a sampling system, and the instrument has an extremely fast response time. The logarithmic output can also be used for the measurement of extremely low oxygen partial pressures or over a wide range of oxygen concentrations. Measurement of the oxidizing power of a protective atmosphere can be directly related to the oxygen partial pressure, which would be valuable in metal heat treatment processes, such as an annealing furnace or carburizing.

1472 APTIC NUMBER 16577

Ries, E. D. and L. E. Clark
ANALYSIS OF SULFUR DIOXIDE IN THE PRESENCE OF EXCESS AIR. Ind. Eng. Chem., vol. 18:747, July 1926. 2 refs.

Various methods for determining of small amounts of sulfur dioxide in air were tested. Triple-distilled sulfur dioxide, dried with concentrated sulfuric acid, and air of known, low humidity were used for the tests. All methods were compared on an absolute basis. Absorbents tried were solutions of iodine in potassium iodide, sodium peroxide, sodium hypochlorite, alkaline iodine, alkaline potassium permanganate, acid potassium dichromate, iodine plus sodium bicarbonate, sodium hydroxide, sodium hydroxide plus 5% glycerol, sodium hydroxide plus 50% glycerol, sodium hydroxide containing 0.001 mol stannous chloride per l, and sodium hydroxide containing 0.002 mol stannous chloride per l. Solid lead peroxide and a water suspension of solid lead peroxide were also tried. The sodium peroxide and sodium hydroxide plus glycerol or stannous chloride were the only methods which gave satisfactory results. The following method was adopted. Sulfur dioxide is absorbed by bubbling the gas through 10 cc of 10% sodium hydroxide solution, 0.002 M in stannous chloride, contained in a modified 4-bulb Mitscherlich absorber. The solution is then washed into a flask, diluted to 50 cc, cooled, 50 cc of 12 N hydrochloric acid added, the solution cooled again, and 2 cc of carbon tetrachloride added as an indicator. The solution is then titrated with approximately 0.003 M potassium iodate. The flask is shaken vigorously during the titration until the pink color of the carbon tetrachloride disappears. A blank must be run on the caustic plus stannous chloride to determine the correction for the catalyst. This analysis is important for control work in commercial processes, such as contact sulfuric acid and paper manufacture.

1473 APTIC NUMBER 17586

Rotariu, George J., Elizabeth L. Hoskins, and Donald M. Hattori
DEVELOPMENT OF KRYPTON-85 CLATHRATE: ANALYTICAL TECHNIQUES TO MEASURE OXIDATION-REDUCTION PRODUCTS IN THE LIQUID STATE. (FINAL REPORT). Booz, Allen Applied Research, Inc., Glenview, Ill., AEC Contract AT(11-1)-1061, 98p., July 1962. 42 refs.
CFSTI: TID-17223

A new clathrate analytical technique was developed, useful for measuring low concentrations of metal ions and sulfur dioxide in liquids. A device was also developed, employing this principle for use in process control. The trace chemicals to be investigated were SO2 gas, ferric ion, cobaltic ion, and uranyl ion; the technique to be developed was to have a specificity for the metallic ions, particularly for the ferric ion. The basic technique investigated was a metal ion-complex reaction with radioactive hydroquinone: Kr-85 in an inert liquid environment, and this was developed for ferric ion. Reaction of ferric ion - TTA and HCl gas with this clathrate (all in trifluorotoluene) resulted in the release of Kr-85 proportionate to ferric ion concentration, in the 2 to 20 ppm range. A laboratory column prototype apparatus, suitable for process control use, was built, but this did not give satisfactory results. The NaCl crystals used gave adsorption of ferric-TTA. Further development work is needed to determine an optimum substrate inert material for use in this column. The parts-per-billion range of ferric ion analysis was opened up through use of the fluorocarbon FC-43 (heptacosfluorotricbutylamine), but results indicated a peculiar inversion-like effect on the amount of Kr-85 released, suggesting that the clathrate was made more stable by the presence of TTA or ferric-TTA in this fluorocarbon. Two new reactions were uncovered in the SO2 work. Little was done with the cobaltic and uranyl ions beyond the complexing stage. (Author abstract modified)

1474 APTIC NUMBER 12314

Rotheram, M. A.
LABORATORY CONTAMINANT SENSOR. (FINAL REPORT). Perkin-Elmer Corp., Pomona, Calif., Aerospace Systems, Contract NAS 1-7266,

CR-66606, 103p., March 1968.
CFSTI: N68-23461

The theory, development, and testing of a sensor instrument for detection of contaminants in spaceship atmospheres is described. The instrument design is based on the use of an accumulator cell which contains a sorbent for extraction of contaminants from air at room temperature. Be heating the cell, contaminants are desorbed through a special inlet system to a mass spectrometer for identification and determination. The performance of the instrument was evaluated by tests with a variety of typical contaminants, including such compounds as acetaldehyde, benzene, butene-1, carbon disulfide, carbon monoxide, formaldehyde, hydrogen chloride and sulfide, methane, nitric oxide, nitrous oxide, sulfur dioxide and toluene. Three sorbents - Porapak Q, charcoal, and Molecular Sieve 5A - were used to sorb the various contaminants. A palladium-coated charcoal sorbent was prepared and successfully tested for the detection of carbon monoxide. Lower detectable limits for contaminants range from 0.5 to 5 ppm with the analytical conditions used. These conditions can be changed to permit detection of smaller concentrations. Identifications of contaminants is facilitated by the use of three sorbents and programmed temperature desorption. A characteristic desorption temperature is determined for each contaminant. Correlation between boiling point and this desorption temperature, in addition to the mass spectra deduced from the desorption curves, provide information for identification of unknown contaminants. The test results demonstrate that this instrument concept has considerable potential for detection, identification, and quantitative determination of atmospheric contaminants. (Author abstract modified)

1475 APTIC NUMBER 17450

Ryszka, E.
FORMATION OF VELOCITY AND DUST PROFILES OF FLOWING GAS-DUST MIXTURES IN DUCTS BY MEANS OF NOZZLES. (Gestaltung von Geschwindigkeits-und Staubprofilen stroemender Gas-Staub-Gemische in Rohrleitungen mittels Duesen). Text in German. Luft Kaeltetech., 5(1):8-17, Feb. 1969. 10 refs.

The production of reproducible velocity-and dust profiles of gases by nozzles in pipes and whether the profiles are symmetrical to the pipe axis was studied, in addition to the types of profiles produced by nozzles. The theoretical and practical advantages gained by the knowledge of the velocity and dust profiles in pipes are enumerated. Measurements in the range of Reynolds numbers 1700 to 34000 were taken and the reproducibility of the gas velocity profiles was confirmed. The gas velocity profiles were also computed and compared with the measured values. There was good agreement; the maximum difference was 0.061. The mean dust quantity of the gas was determined with a filter across the entire measurement cross section. These measurements were limited to the Reynolds number 4000. The results are illustrated in a diagram for nozzles with a diffusor angle of 9 deg 30 min 45 sec and 90 deg. For diffusor angles of 15, 25, 180, 270 and 360 deg the dust distribution behind nozzles is similar. A study of the dust profile showed that at low speed the dust concentration increases rapidly with increasing gas velocity but increases less at higher velocities. The nozzle with a diffusor angle of 90 degrees concentrated the dust best. Thus dust can be concentrated in the direction of the pipe axis by the use of nozzles.

1476 APTIC NUMBER 17567

Saltzman, Bernard E. and Nathan Gilbert
IODOMETRIC MICRODETERMINATION OF ORGANIC OXIDANTS AND OZONE. RESOLUTION OF MIXTURES BY KINETIC COLORIMETRY. Anal. Chem., 31(11):1914-1920, Nov. 1959. 22 refs. (Presented at the American Chemical Society, Division of Water, Sewage, and Sanitation Chemistry, Air Pollution Symposium, 136th Meeting, Atlantic City, N. J., Sept. 1959.)

A kinetic colorimetry technique for spectrophotometrically resolving and determining micro quantities of components in mixtures is described. The method involves adding a slow-reacting reagent and measuring the developed color at progressive time intervals until maximum color is obtained. The logarithms of the undeveloped color is plotted against the reaction time, with characteristic plots resulting for pure substances and binary mixtures; more complex mixtures could presumably be handled as well. The technique was successfully applied to the iodimetric microdetermination of various oxidants in liquid dilutions, and to the study of the stoichiometry of iodide reagents with low concentrations of ozone in air. Reactions appeared to involve both hypoiodite and perphosphate. The most satisfactory reagent was 1% potassium iodide in neutral phosphate buffer. Comparisons were made with an independent method found to be specific for ozone in gaseous mixtures, based on converting ozone to nitrogen dioxide by reaction with excess nitric oxide. These methods should be valuable for differentiating natural smog oxidant into its components and the kinetic colorimetry technique should have broad analytical applications in making specific determinations, even if the available reactions are nonspecific. (Author abstract modified)

1477 APTIC NUMBER 12491

Saltzman, Bernard E.
PRESENT STATUS OF TESTING OF METHODS FOR MEASUREMENT OF AIR POLLUTANTS. Preprint, Air Pollution Control Association, New York City, 34p., 1967. 26 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 60th, Cleveland, Ohio, June 16, 1967, Paper 67-154.)

Standard methods of air analysis are needed as a scientific basis for air quality criteria, as well as for engineering and legal aspects of abatement action. Currently available compilations of air analysis methods were listed. The Analytical Methods Evaluation Service of the National Center for Air Pollution Control conducted a survey of the instruments and manual methods of analysis now in use. Responses were tabulated from about 80 laboratories in 28 states and 3 foreign countries. Sulfur dioxide was the most widely measured pollutant. The numbers of instruments of each type in use, and comments on performances were given. The listings permit an evaluation of the relative importance of various methods of analysis. The first collaborative study organized by the Analytical Methods Evaluation Service was described. The purpose was to evaluate the permeation tube technique as a primary standard method for generating known sulfur dioxide concentrations for instrument calibration and methods testing. It was believed that the technique is simple, convenient, and relatively inexpensive. The study should result in improvements of calibration systems and methods of analysis. Laboratories were urged to devote substantial efforts to support this work. It was also emphasized that once a method is accepted as standard, work should continue on improvement or development of a superior method of analysis.

1478 APTIC NUMBER 17468

SOURCES OF ATMOSPHERIC SULFUR DIOXIDES AND MEASUREMENT METHODS. (Taikichu no iousankabutsu no hasseigen to sokuteihoho). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 5(10):612-620, Oct. 25, 1969. 62 refs.

Atmospheric sulfur dioxide exists in various chemical and physical forms; under normal conditions, it is in a gaseous state containing some volatile sulfuric mist and sulfate. If gaseous sulfur dioxide were the only atmospheric pollutant, its measurement would not be so difficult. The existence of sulfuric mist and sulfate and other interfering substances in the atmosphere make analytical procedures intricate. Some difficulties in analytical assessment of atmospheric SO_2 are also correlated with the limits involved in technical methods, some of which, like the West-Gaeke or electroconductivity methods, are subject to error due to the existence of atmospheric interfering elements at variance with the substantial characteristics of SO_2. Therefore, in evaluating measurements obtained from applied methods and laboratory techniques, allowance must be made for sequential and accidental errors. Atmospheric values obtained with the different methods are apt to vary. The widely used analytical procedure for SO_2 determination involves separating mist from sulfuric mist and measuring the sulfur in the sulfate contained in the air sample. The quantity of SO_2 is determined simultaneously with the measurement of suspended sulfate in an aerosol state or contained in dust fall. In 1965, the amount of sulfurous acid gas emitted to the atmosphere was 23,400,000 t. In 1966, the amount was 28,600,000 t of which 58.2% came from coal combustion in thermal power plants; 19.6%, from oil combustion; 5.5%, from petroleum refinery processes; 12.2%, from mine refinery processes; 1.9%, from sulfuric acid production; and the rest, 0.4%, from waste incineration. Various types of SO_2 analyzers, including currently improved U. S. models, are presented.

1479 APTIC NUMBER 12492

Sawatani, Tsugio
THE PROBLEMS OF ODOR NUISANCE. 4. THE MEASUREMENT OF ODOR. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 2(1): pagination not given, 1967. 9 refs. Translated from Japanese. 19p.

The measurement of odors is generally divided into separating and estimating the components of a gas sample and measuring the intensity of an odor. There are few occasions when the components of a sample can be determined by gas chromatography, so measurements are usually made with concentrates. Measurements of the intensity of an odor generally depend on the sense of smell. Because there is no way to evaluate the response to an odor on a numerical basis, equipment for measuring odor itensity has not been developed. A specific bond is assumed to exist among the molecules of a substance which has an offensive odor. For example, ammonia, methyl, and amine have a similar smell that is presumably due to the $-NH_2$ group. The idea the flexible vibration of the N-H coupling stimulates the olfactory nerve implies a possible relationship between the propagation and quality of a smell and the infrared-absorbing wave-length of its molecule. Problems complicating the measurement of a gas mixture are discussed, and a simple sampling apparatus is described for measuring the odor, of a mixed gas by the salt-solution equilibrium process.

1480 APTIC NUMBER 12145

Sawicki, Eugene, Thomas W. Stanley, and Thomas R. Hauser
DETECTION OF HETEROSUBSTITUTED AROMATIC COMPOUNDS AND QUANTITATION OF AROMATICS IN THE AIR. Preprint, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, Community Air Pollution Program, 5p., 1958 (?). 2 refs.

Directions are given for detecting certain aromatic compounds in air particulate matter collected on a glass fiber filter and extracted with pure benzene. The procedure is based on the fact that aromatic compounds react in trifluoroacetic acid with various types of arylidene halides to give intensely colored diarylmethane dyes. Piperonal chloride has proven to be the most versatile of the analytically useful arylidene halides. The following types of compounds do not react: aliphatics, benzene, quinones, and electronegatively-substituted compounds such as acetophenone and nitrochrysene. Test results are given for a representative list of heteroaromatic and aromatic compounds, with color and wavelength maximums for each. The sensitivities are all less than 0.01. Positive results are obtained with aromatic and heteroaromatic compounds which have their highest electron density at an aromatic carbon atom and are more basic than benzene under the conditions of the test. The K-value (the specific absorption coefficient of organic matter from 1000 cu m air per 100 ml of treated solution) is obtained from the quantitiative visible absorption spectral curve and is directly proportional to the amounts of simple-to-complicated aromatic compounds present in the sample. Various wavelength maxima and inflection points are obtained from which the complexity of the aromatic compounds present in the mixture can be deduced, the more conjugated compounds tending to absorb at longer wavelengths.

1481 APTIC NUMBER 17496

Sawicki, E., R. C. Corey, A. E. Dooley, J. B. Gisclard, J. L. Monkman, R. E. Neligan, and L. A. Ripperton

TENTATIVE METHOD OF SPECTROPHOTOMETRIC ANALYSIS FOR BENZO(A)PYRENE IN ATMOSPHERIC PARTICULATE MATTER. Health Lab. Sci. Suppl., 7(1): 68-71, Jan. 1970. 2 refs.

Airborne particulates are extracted exhaustively with an organic solvent, reduced to tarry residues through evaporation in vacuo, and separated on thin-layers of activated alumina. The fluorescent area of pure benzo(a)pyrene and a corresponding area of the sample are removed and eluted, and solutions of the pure compound and the unknown are measured spectrophotometrically between 400 and 240 nanometers to determine the amount of BaP present. For a polluted atmosphere containing 500 micrograms BaP per gram organic extract, more than 0.4 milligram of extract from approximately 40 sq m of air would be necessary for analysis, and as much as 5 milligrams of extract can be separated and concentrations as low as 50 micrograms BaP per gram extract can be determined. Any compound absorbing wavelengths between 390-375 nanometers would be an interference, and the BaP concentration averaged 546 micrograms per gram extract with a plus or minus 7 per cent relative standard deviation when a large composite air sample was analyzed by the column chromatographic procedure. An absorbance of 1.0 is yielded with 14 micrograms of pure BaP in 1 mililiter of solution, and a concentration vs. absorbance curve is linear from 14 micrograms through the origin, although values have to be corrected for predetermined elution efficiency. Standard solutions, which are kept cold, in the dark, and refrigerated immediately after each use, are stable for a short time; residues can be stored for several years, but aluminum oxide plates should not be stored for more than three weeks.

1482 APTIC NUMBER 17556

Sawicki, E., R. C. Corey, A. E. Dooley, J. B. Gisclard, J. L. Monkman, R. E. Neligan, and L. A. Ripperton
TENTATIVE METHOD OF ANALYSIS FOR C1 THROUGH C5 ATMOSPHERIC HYDROCARBONS. Health Lab. Science, vol. 7:23-30, Jan. 1970. 1 ref.

An air sample is introduced into a chromatograph column containing activated alumina coated with B,B' oxydipropionitrile (0 deg C) using helium as a carrier gas. This gas stream is then introduced into a hydrogen-oxygen flame ionization detector and hydrocarbon molecules are ionized, collected at the electrodes measured by an electrometer connected to a strip chart recorder. The lower limit of measurement for the various hydrocarbons is 0.01 parts per billion by volume, which can be extended to 0.1 parts per billion for the C1 through C5 hydrocarbons by concentrating 100 milliliters of the gas sample in a freeze trap. Selection of the sampling site should be reasonably distant from local sources of hydrocarbon emissions and in a locale where the surrounding topography is conducive to adequate mixing of the ambient atmosphere.

1483 APTIC NUMBER 12370

Sehmel, G. A. and L. C. Schwendiman
PARTICLE DEPOSITION WITHIN A CURVED SAMPLING PROBE. In: Pacific Northwest Laboratory Annual Report for 1967 fo the USAEC Division of Biology and Medicine, vol. II: Physical Sciences, Part 3. Atmospheric Sciences. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab., p. 88-92, Oct. 1968.
CFSTI: BNWL - 715

Air particle samples are often collected under conditions in which the filter collector medium can not be placed directly in the air stream. Thus, the sampled air must reach aerosol particle deposition was measured in 4.7 to 5.8-in. lengths of 0.135 to 0.40-in. ID tubing formed on a 4.4-in. radius of curvature. For a constant sampling velocity, the deposition increased with an increase in particle size and a decrease in tubing ID. For a constant tube ID, deposition increase with both flow rate and particle size until reentrainment became important. For transition flow between laminar and turbulent, the deposition was minimum for an intermediate Reynolds number for any constant particle size for which reentrainment was not important. The disposition was significant for all flow rates and must be considered in interpreting the data for any sample passed through a curved tube in either laminar or turbulent flow. (Author abstract modified)

1484 APTIC NUMBER 12372

Sehmel, G. A. and L. C. Schwendiman
PARTICLE COLLECTION EFFICIENCIES ON WIRES. In: Pacific Northwest Laboratory Annual Report for 1967 to the USAEC Division of Biology and Medicine, vol. II: Physical Sciences, Part 3. Atmospheric Sciences. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab., p. 96-100, Oct. 1968. 16 refs.
CFSTI: BNWL-715

Fine wires could serve as particle samplers near surfaces or in other situations demanding small disturbances of the sampled air. Good sensivity, adequate reproducibility, and accuracy would have to be shown before impaction on wires could be qualified as an acceptable sampling method. Collection efficiencies of monodispersed 4 to 27 micron uranine particles were determined for 0.020 in. diameter wires for an air velocity of 18.6 ft/sec. The wires were covered with a thin layer of petroleum jelly. Collection efficiencies decreased as the projected wire area covered by the particles increased above about 1%. This decrease has not been previously reported and may explain some of the scatter in literature values of impaction efficiencies. (Author abstract)

1485 APTIC NUMBER 12371

Sehmel, G. A. and L. C. Schwendiman
THE EFFECT OF SAMPLING PROBE DIAMETER ON SAMPLING ACCURACY. In: Pacific Northwest Laboratory Annual Report for 1967 to the USAEC Division of Biology and Medicine, vol. II: Physical Sciences, Part 3. Atmospheric Sciences. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab., p. 92-95, Oct. 1968. 2 refs.
CFSTI: BNWL-715

Isokinetic sampling of particles from an air stream is an important requirement in determining the airborne particle concentration. Errors can result, nevertheless, from several sources, even when the isokinetic condition is maintained. Isokinetic sampling errors were studied as a function of sampling probe diameter for a particular conduit and probe geometry. Singe-sized (1 to 28 in. diameter) uranine particle were sampled through aluminum probes with ID of 0.135, 0.210, 0.285, and 0.402 in. The inlets of the probes were located on the axis of a 2.81 in. ID vertical tube. Isokinetic sample rates, based on the maximum tube velocity, were studied for an average velocity of 18.0 to 19.6 ft/sec. The measured concentration ratios were near unity and ranged 0.8 to 1.2. In general, the concentration ranges for particle diameters less than 15 micron were higher for the smaller diameter probe. For 28 micron particles, the concentration ratios were 0.78 to 0.85. This decrease in concentration ratio below unity is attributed to the effects of particle concentration profiles across the sampled tube. For 28 micron particles at these flow conditions, the particle concentration is greater near the sampled tube wall than at the tube axis. As a result, fewer particles are collected in the sample probe than in a uniform concentration.

1486

APTIC NUMBER 18093

Smith, Hermes O. and Arthur D. Hochstettler
DETERMINATION OF ODOR THRESHOLDS IN AIR USING C14-LABELED COMPOUNDS TO MONITOR CONCENTRATIONS. Environ. Sci. Technol., 3(2):169-170, Feb. 1969. 1 ref.

The minimum identifiable odor levels of compounds in air were determined using a static dilution technique. Since adsorption of the compounds on the surfaces of equipment during the diluting procedures can potentially cause unknown and high errors, it is important to determine the true concentration in the air at the minimum identifiable odor level concentration. The authors do this by using C14-labeled compounds and scintillation counting. Results for styrene, monochlorobenzene, and monochloroacetic acid are reported. (Author's Abstract)

1487

APTIC NUMBER 17419

Smith, J. F., J. A. Hultz, and A. A. Orning
SAMPLING AND ANALYSIS OF FLUE GAS FOR OXIDES OF SULFUR AND NITROGEN. Bureau of Mines, Washington, D. C., Report of Investigations 7108, 21p., 1968. 17 refs.

A series of studies of emissions from large coal-fired steam generators included measurements of the concentrations of sulfur oxides and nitrogen oxides in the combustion products. The mobile sampling equipment, method of sampling, and analytical techniques used for processing the samples are detailed. An adaption of the phenoldisulfonic acid procedure was used for the determination of nitrogen oxides. The Berk and Burdick procedure was first used for the determination of SO2 and SO3. This procedure is based on an acidimetric determination of bisulfite plus sulfate with independent determination of sulfate through benzidine sulfate precipitation. An interference, conceivably due to organic acids in flue gases from coal combustion, was found to give high sulfur balances. A modified process was therefore developed on the basis of the benzidine sulfate precipitation for both the SO3 and the total sulfur oxides content.

1488

APTIC NUMBER 17555

Smith, R. G., R. J. Bryan, M. Feldstein, B. Levadie, F. A. Miller, E. R. Stephens, and N. G. White
TENTATIVE METHOD OF ANALYSIS FOR CARBON MONOXIDE CONTENT OF THE ATMOSPHERE (MANUAL--COLORIMETRIC METHOD). Health Lab. Sci., Suppl., 7(1):75-77, Jan. 1970. 2 refs.

A new method for carbon monoxide detection is based on the reaction of carbon monoxide with an alkaline solution of silver salt of p-sulfaminobenzoic acid to form a colloidal suspension of silver. The absorbance of the resulting suspension is read in a spectrophotometer, and concentrations of CO are calculated by reference to calibration curves prepared for known concentrations. The range of concentration which can be measured by the procedure depends on the wavelength and sample concentration used to measure absorbance. A low range of 0 to 20 microliters CO/50 ml sample corresponding to 0-400 ppm is covered by the 424 mm wavelength, and 20 to 90 microliters CO corresponding to 400-1800 ppm, by the 600 mm wavelength. To avoid interference by acetylene, hydrogen sulfide olefins, and aldehydes, the sample should be passed through a silica gel filter containing H2SO4. Explicit instructions are given for the analytical procedure.

1489

APTIC NUMBER 17488

Stephens, B. G. and H. A. Suddeth
SPECTROPHOTOMETRIC DETERMINATION OF SULFUR DIOXIDE BY REDUCTION OF IRON (III) AND SIMULTANEOUS CHELATION OF THE IRON (II) WITH 2,4,6-TRI(2-PYRIDYL)1,3,5-TRIAZINE. Analyst, vol. 95:70-79, Jan. 1970. 10 refs. (Presented at the Society for Analytical Chemistry, 2nd Conference, Nottingham, England, 1968.)

The iron-1,10-phenanthroline method is useful for the selective determination of sulfur dioxide in complex auto exhaust mixtures, but the sensitivity of the method is affected by changes in bubbler temperature. The West and Gaeke modified pararosaniline-formaldehyde method is sensitive but involves a cumbersome development step. The spectrophotometric method proposed for sulfur dioxide determination has high sensitivity and requires no development step. Gaseous samples containing sulfur dioxide are scrubbed in solutions containing iron (III), 2,4,6-tri(2-pyridyl)-1,3,5,-triazine, and propylene carbonate. The amount of violet bis 2,4,6-tri(2-pyridyl)-1,3,5,-triazine-iron (II) complex ion formed is measured spectrophotometrically at 593 mm. Increased sensitivity is attained by extracting the complex ion into propylene carbonate-chloroform solutions. The flow rate of the incoming gas stream may be up to 12 l/min for atmospheric samples, without significant loss of sulfur dioxide. Temperature effects are minimal and only manganese (II) and hydrogen sulfide are serious interferences. Beer's law is obeyed over the range 3 to 57 micrograms of sulfur dioxide. Since the color forms as the sample is taken, automation or continuous application of the method should be feasible. The use of permeation tubes for atmospheric samples is discussed. (Author abstract modified)

1490 APTIC NUMBER 17753

Tada, Osamu and Sumie Fukabori
ON THE DETERMINATION OF N-HEXANE IN THE AIR. (Kichu n-hekisan no sokutei ni tsuite). Text in Japanese. Rodo Kagaku (J. Sci. Labour, Tokyo), 45(9):535-544, 1969. 11 refs.

Experiments were conducted to determine the suitability of sulfuric acid-formaldehyde for the colorimetric determination of n-hexane in air. Methods of collecting the n-hexane vapor were also examined. The reagent was prepared by mixing 0.1 ml of 10% formalin with 100 mol of concentrated sulfuric acid. The vapor was satisfactorily absorbed in ethanol by a midget bubbler or impinger, with collection efficiencies varying according to suction rate, volume of air sample, temperature of the cooling of the absorbent, and concentration of the vapor. One ml of the absorbing solution was added to 5 ml of the sulfuric acid-formaldehyde reagent. The mixture was shaken and allowed to stand for 10 min at room temperature, after which 1 to 3 ml of distilled water was added. The colored solution was then cooled to room temperature and the absorbance measured at 352 and 450 micron. The absorbance at the first wavelengths was increased by the addition of 1 mol of distilled water; at the second, by 3 mol. The detectable limits of n-hexane vapor obtained by the absorbance measurements were 2 and 5 microliters per ml of ethanol. (Author abstract modified)

1491 APTIC NUMBER 12128

Todd, W. F., J. E. Hagan, and P. W. Spaite
TEST DUST PREPARATION AND EVALUATION. Preprint, American Industrial Hygiene Assoc., Detroit, Mich., 21p., 1963. (Presented at the American Industrial Hygiene Association Annual Meeting, Cincinnati, Ohio, May 9, 1963.)

The analysis of calibration dust by different techniques in different laboratories resulted in encouraging agreement and interesting differences. Bahco classifications were run on 7 instruments in 6 laboratories. The agreement on individual instruments was proof of the suitability of the dust for calibration and to the reproducibility of results from individual Bahco instruments. The similarity of the fractions obtained on 5 instruments indicated that good agreement may generally be expected between instruments. Data were compared from analyses of a Bahco calibration dust by the use of a Coulter Counter and an optical sedimentation device. The interchangeability of the techniques was shown by the similarity of particle-size distribution curves. It was also shown that the limestone whiting used for preparation of the calibration dust was inexpensive and suitable for the testing of particulate removal equipment because of its uniformity and because of the balance in weight fractions observed in the sizes between the sub-micron sizes and the 50-microon fraction. The calibration dust may also be useful for evaluating other types of particle-analysis equipment, provided the user takes into consideration the solubility characteristics of the dust which are slight but significant. It must also be recognized that the results obtained may not agree with the distribution curves contained in this paper, which were constructed from analyses of fractions obtained from Bahco classifications. (Author summary modified)

1492 APTIC NUMBER 17752

QUANTITATIVE DETERMINATION OF MANGANESE COMPOUNDS IN THE AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:41-44, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

In the Soviet Union, the limit of the allowable concentration of manganese its compounds in the air is 0.3 mg/cu m in terms of MnO2. A method is presented for determining manganese concentrations in the air of industrial premises. It is based on the property of manganese compounds to oxidize to manganic acid (H2MnO4) with the aid of ammonium persulfate in the presence of a silver nitrate catalyst. The oxidation produces a color intensity which increases with the increase in the concentration of manganese in solution. Final determination is made colorimetrically with the aid of a standard scale. The method is suited to the determination of manganese salts and manganese oxy-compounds.

1493 APTIC NUMBER 17771

QUANTITIVE DETERMINATION OF TETRAETHYL LEAD IN GASOLINE OF DIFFERENT TRADE MARKS AND IN KEROSENE. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:64-69, 1963. (B. S. Levine, ed.)
CFSTI:63-11570

A method for the determination of small quantities of tetraethyl lead in gasoline used as solvents and automobile fuel, and in kerosene was described. Tetraethyl lead is decomposed by iodine and the lead ion is determined as lead chromate. The sensitivity of the method is 0.00156 micrograms of tetraethyl lead per analyzed volume of the solution. The method consists of adding a few crystals of iodine to 50 ml of filtered gasoline in a procelain dish. The solution is evaporated and the dry residue is dissolved in 4-6 ml of 3% ammonium acetate and centrifuged. Two and a half ml of the clear solution is placed in colorimetric tubes, and 3% ammonium acetate is added until a total volume of 5 ml is reached. To all the tubes, 0.1 ml of 3% potassium chromate is added and after standing for 15-20 minutes, the solutions are nephelometrically compared against a dark background.

1494 APTIC NUMBER 17793

QUANTITATIVE DETERMINATION OF FORMALDEHYDE IN THE AIR. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:55-59, 1963. (B. S. Levine, ed.)

CFSTI: 63-11570

A method for the determination of formaldehyde in the air of industrial premises for sanitary control purposes was described. The method is based on the reaction between formaldehyde and fuchsin sulfate in an acid medium. Air is aspirated at the rate of 20 l/hr through 2 consecutively connected absorbers, each containing 10 ml of distilled water. One and five ml samples from the first absorber and 5 ml from the second absorber are placed into colorimetric tubes. Four ml of distilled water is added to the tube containing the 1 ml sample. The standard scale is simultaneously prepared. One ml of fuchsin sulfate reagent is added to all the tubes and shaken. The tubes are allowed to stand for 30-40 minutes; 1 ml of 1:3 sulfuric acid solution is added, and the solutions are compared colorimetrically. The sensitivity of the method is 2 mg of formaldehyde per colorimetric volume. Other aldehydes in concentrations of 300 mg or less per colorimetric volume do not interfere with the determination. All aldehydes react with fuchsin sulfate to form a rose-violet color. The presence of less an 300 mg of aldehydes, other than formaldehyde, develop a rose-violet color which generally fades out. The color developed by formaldehyde and fuchsin sulfate does not fade out but turns a rose-violet color in an acid medium, gradually changing to blue-violet.

1495 APTIC NUMBER 12479

Watanabe, Shinya
THE PROBLEMS OF ODOR NUISANCE. 2. SELECTION OF ESTIMATORS IN SENSORY MEASUREMENT OF ODORS. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 2(1):15-17, 1967. Translated from Japanese. 8p.

Despite advances in the chemical analysis of odors, an evaluation of an unpleasant odor in relation to human feelings and sensations must inevitably rely on the human sense of smell. A panel is required for this purpose whose judgement is representative of the local residents concerned. Panel members must have the ability to distinguish a specific odor from another, to detect the existence of a specific component in a mixture, and to differentiate accurately between variations in odor intensity. The size of a panel should be determined according to the purpose and scale of the investigation. Six to ten persons can constitute an effective panel if they are well trained and properly selected. For a large-scale investigation carried out simultaneously at numerous points, a mass panel is appropriate.

1496 APTIC NUMBER 17575

Yankovskiy, I. A.
ON CORRELATING THE EXPERIENCE OF STATIONS FOR MONITORING THE CHEMICAL COMPOSITION OF AIR IN CITIES. (K obobshcheniyu onyta raboty postov nablyudeniy za khimicheskim sostavom atmosfernogo vozdukha gorodov). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 234:116-124, 1968. 1 ref.

The methodology and organization of work as related to coordinating the operations of various air pollution monitoring stations is considered. Topics discussed are selection of sampling sites; equipment; sampling methods; and meteorologic observations at monitoring stations. Experience and practices of meteorological services in various cities are reviewed. An air-monitoring booth is depicted and an air vane sample intake device is described. An air preheater and thermostat which permit monitoring at temperatures to -38 C are also described and the proper pedestal arrangement for mounting an anemometer and psychrometer is presented.

1497 APTIC NUMBER 18068

Zambonin, Pier Giorgio and Joseph Jordan
GAS ENTHALPIMETRY. Anal. Chem., 41(3):437-442, March 1969. 25 refs.

Gas Enthalpimetry (GE) is an "equilibrium heat pulse" method applicable to reactions between gases and liquids. Gaseous samples were injected, under judiciously controlled experimental conditions, into thin walled adiabatic calorimeters--e.g., platinum lined styrofoam. A temperature change was concomitantly monitored with the aid of automatic thermistor instrumentation which had the sensitivity of a thousand-junction thermocouple. Aquation and Bronsted acid-base reactions of the gases CO_2, SO_2, NO_2, and N_2O_4 were investigated systematically. Heats of reaction were determined by GE in a few minutes with a precision and accuracy of 1%, which is comparable to the capabilities of classical calorimetry with such systems. GE is ideally suited for quantitative gas analysis: CO_2 and SO_2, were determined accurately in amounts between 0.5 and 1000 micro moles, in gas mixtures ranging from 0.1 to 100 ml in volume and containing from 1 to 50% of the "unknown." Based on the comprehensive study of aqueous CO_2, SO_2, and NO_2 systems, heat of reaction assignments and associated confidence intervals are assessed critically. (Author's Abstract)

AIR QUALITY MEASUREMENTS

1498 APTIC NUMBER 12345

Alkire, H. L.
AIR POLLUTION IN GARRETT COUNTY MARYLAND. Maryland State Department of Health, Baltimore, Div. of Air Quality Control, 28p., March 1969. 12 refs.

The results of a preliminary survey of air pollution conditions, collected from existing data and personal interviews in Garrett County, Md., are presented. The county, the westernmost in the state, is the second largest in area but the most sparsely settled. Its topography, meteorology, and land use are described. Visual and odor observations and pollution measurements show that a serious air pollution problem exists in the Bloomington area in the valleys of the southeastern portion of the county. This problem originates outside the boundaries of the county, specifically in the Luke, Maryland - Beryl - Hampshire, West Virginia area. Bloomington School had suspended particulate at 135%, dustfall at 300%, and sulfation at 120% of satisfactory levels. The main sources of contamination in the Bloomington area are the paper mill at Luke, the charcoal plant in Beryl, and a coal screening operation in Hampshire. No measurements of air pollution have been made in the other portions of the county, but indirect indicators suggest that no serious air pollution problems exist, or are likely in the foreseeable future. Several recommendations are made for improving the pollution problems now existing.

1499 APTIC NUMBER 17767

Beebe, Robert G.
CHANGES IN VISIBILITY RESTRICTIONS OVER A 20 YEAR PERIOD. Bull. Am. Meteorol. Soc., 48(5):348, May 1967. 1 ref.

Changes in visibility restrictions are reported for 8 Weather Bureau Airport Stations whose location and point of observation was not changed from 1945 to 1965. Data were compiled on smoke and haze only for visibilities of 6 miles or less during the month of January. Data from January 1945 and 1965 were compared. Visibility restrictions due to smoke and smoke with haze decreased 82% between 1945 and 1965. Restrictions due to haze and haze with smoke remained the same. The amount and character of smoke changed appreciably. In 1945, locomotives, industries, and many homes were burning coal which produced black smoke. Smoke from a factory or other source today loses its color within a few blocks or miles and thus it is often difficult for the ground observer to distinguish between smoke and haze. Areas that are completely free of local smoke sources may have visibility restrictions due to pollutants that were produced many miles away.

1500 APTIC NUMBER 16271

Bouquiaux, J. and J. Grandjean
ATMOSPHERE POLLUTION, SMOKE AND SO2. Bull. Mens. Inst. Royal Meteoral. Belgique, 17p., June 1968. Translated from French and Flemish. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 17p., Sept. 26, 1969.

Tables and graphs of the average daily levels of smoke and SO2 pollution in Belgium are presented. The sampling apparatus consisted of a membranous electric pump that takes in about 2 cu m of air per day, a Whatman paper filter no. 1, a scrubber containing 50 ml of oxygenated water at a pH of 4.5, and a gas meter. The apparatus also included 8 filter-scrubber circuits that were automatically switched on each morning. Collection of samples was carried out once a week. Reflectometric analysis of the filter and acidometric testing of the liquid from the scrubber provided an average proportion of fumes and SO2 per cu m of air during the 24 hours of sampling. The network comprised 230 sampling stations. One hundred stations were located in the cities of Brussels, Antwerp, Liege, Charleroi, and Ghent; another 100 were located in less important cities and selected centers across the country; and 30 were located in meteorological stations equipped with anemometers. Analytical laboratories were located in the five large cities.

1501 APTIC NUMBER 11867

Bryan, Robert J. and James R. Taylor
AN AIR SAMPLING STUDY IN CONJUNCTION WITH THE EXPOSURE OF ANIMALS TO DETERMINE BIOLOGICAL EFFECTS OF AUTOMOTIVE EMISSIONS AS AIR POLLUTANTS. Preprint, Air Pollution Control Association, New York City, 52p., 1965. 2 refs. (Presented at the Air Pollution Control Association Annual Meeting, 58th, Toronto, Canada, June 24, 1965, Paper 65-133.)

A large-scale study initiated in 1961 in Los Angeles to determine the effects of automotive emissions on several types of experimental animals is described. At each of four separate locations, two colonies of animals were exposed, one to unaltered ambient air and one to purified air. The sites differed in their proximity to major automobile emission source areas. Concommitant air quality data were obtained at each exposure site with continuous automatic analyzers; computer techniques were used for data processing. The air purification system and the reproducibility of various instrumental methods are evaluated. Seasonal comparison of air quality data shows little variation of carbon monoxide, hydrocarbons, and particulates. For total oxidants, the summer quarter is markedly higher than the other three quarters; nitrogen dioxide is also higher in summer but with less variation than total oxidants. Nitric oxide is decidedly higher in fall and winter. Each pollutant showed essentially similar diurnal variations, although relative magnitudes differed at different sites. Graphs of diurnal variations and monthly averages for various contaminants are given, as well as recommendations for future animal studies of the effects of ambient pollution.

1502 APTIC NUMBER 12102

Public Health Service, Washington, D. C. and City of Lynchburg, Va.

A PILOT STUDY OF AIR POLLUTION IN LYNCHBURG, VIRGINIA. Preprint, 22p., 1961.

Intensive air pollution sampling was conducted in Lynchburg, Va. for seven days, Feb. 9-15, 1961, including one weekend and one all-night sampling period. Visibility measurements to ground level objects were taken every hour. Sampling was done for oxidant, nitric oxide, nitrogen dioxide, carbon monoxide, sulfur dioxide, hydrogen sulfide, and particulate matter. The results obtained by the study should only be considered indicative of the magnitude of air pollutants. The levels found clearly indicated the Lynchburg has an air pollution problem. The soiling capacity and particulate matter levels indicated the presence of a general smoke problem. The visibility standard for ambient air of the California State Health Dept. (less than 3 miles at less than 70% relative humidity) was exceeded on 6 days. A combination of meteorological conditions including low wind speed, temperature inversion, and a haze layer at the top rim of the James River Valley was noted on Feb. 15. The highest levels for general air pollution for the entire sampling period occurred during this period and appeared to be attributable to the combined meteorological conditions. The high level of sulfur dioxide was comparable to levels found in many large population centers or highly industrialized areas. The levels for some of the gaseous pollutant were about average for urban areas; however, under conditions of low wind speed and temperature inversion, they may accumulate until much higher levels are reached. A full-time air pollution control program and rules and regulations for air pollution control were recommended. The full-time air pollution control program should include routine air quality monitoring for particulate and gaseous pollutants, an inventory and assessment of air pollution sources, a sources, a public education program, and implementation of effective air pollution control. Air pollution control districts should be established by the state legislature, and future highways and zoning requirements should seriously consider the air pollution potential.

1503 APTIC NUMBER 17360

Craxford, S. R. and M.-L. P. M. Weatherley
ATMOSPHERIC POLLUTION IN GREAT BRITAIN. (La pollution atmospherique en Grande-Bretagne). Text in French. Pollut. Atmos. (Paris). no. 44:187-194, Oct.-Dec. 1969. 2 refs.

The total population, energy consumption, and emissions of black smoke and sulfur dioxide in Great Britain in the years 1952 to 1967 are given. Black smoke emission in the years 1952 to 1967 shows a continuing decrease since 1954 which is directly related to the Clean Air Act of 1956. Analogous data based on other sets of measurements carried out during some of these years are plotted. Almost all black smoke is due to incomplete combustion of fuel oil in boiler furnaces or in inefficient furnaces. The Act required that all changes of the operating equipment should be completed before 1961. Hence, the further decrease a black-smoke emission is due to progressive modernization of the equipment. Total coal consumption and black-smoke emission between 1952 and 1967 is given. The act gave municipalities the power to establish 'smoke control areas' in which the use of domestic fuels other than 'smokeless fuels' is forbidden. These areas contribute significantly to the decrease of the total black-smoke emission. Analogous information regarding SO2 emission, both total and separate according to domestic, industrial, and power plant sources is plotted. No decrease of SO2 emission occurred until 1960, but from that year on, a slow decrease has occurred to the present. The distribution of black smoke and SO2 contents in micrograms/cu m as well as in terms of gigagrams/1 million of inhabitants is given in conjunction with the map of districts of Great Britain. On the basis of the above mentioned air pollution data, forecasts are made for 1970 and 1975 which are quite optimistic.

1504 APTIC NUMBER 17852

Davies, R. R.
AEROBIOLOGY AND THE RELIEF OF ASTHMA IN AN ALPINE VALLEY. Acta Allergol., 24(6):377-395, Dec. 1969. 31 refs.

Pollen and fungal spore content of the air at Davos, Switzerland, and London was studied by means of continuously recording spore traps in 1966 and 1969, in order to understand the relief of bronchial asthma in high mountains. Since the Hirst trap employed in this study has a retentivity for unit density spheres of one hundred per cent for particles greater than 7 micron diameter, and fifty per cent for particles of 4 micron diameter, it simulates the upper respiratory tract in which the naturally inhaled pollens and larger fungal spores are deposited and produce allergic symptoms. Grass pollen concentrations tended to be lower in Davos (altitude 1560 meters) than in London (altitude 29 meters); during comparable periods, mean daily concentrations greater than 50 grains per cu m were recorded on 29 days in Davos and 41 in London. Cladosporium spores were trapped in clinically significant concentrations on only 8 days in Davos in comparison with 67 days in London, and concentrations of total fungal spores (Alternaria, Ustilago, Ascospores and Leptosphaeria) were all much lower in Davos than in London. High Basidiospore concentrations at Davos were associated with local coniferous forests, and mean daily concentrations were greater than 1000 per cu m on 71 days compared to 7 in London. Patients with sensitivities to fungal spores other than those of the Basidiomycetes should gain some relief at Davos. (Author summary modified)

1505 APTIC NUMBER 17785

Gurinov, B. P.
CANCEROGENIC SUBSTANCES IN THE ATMOSPHERIC AIR WITH A VIEW TO CANCER PREVENTION. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:145-152, 1963. (B. S. Levine, ed.)
CFSTI: 63-11570

Studies on the effect of cancerogenic substances present in the atmosphere are reviewed with special reference to 3,4-benzypyrene. The percent of 3,4-benzypyrene present in selected Russian cities is reported and compared with measured levels in the U. S. and

England. Lower levels (100 times less) in the USSR are attributed to differences in the intensity of automobile traffic and to different air sampling methods. Comparative studies of fuel burning methods which indicate that the discharge of cancerogenic hydrocarbons could be eliminated by improved fuel combustion are summarized. Data is presented to show that the layer-bed method of hand-stoked fuel burning produces dust with a high 3,4-benzpyrene concentration, while mechanically stoked fuel produces lower concentrations; burning by the chamber method generated dust with almost no 3,4-benzpyrene. Other investigations indicate that small boiler plants emit smoke and gases containing polycyclic hydrocarbons of the type 1,12-benzoperilene and 3,4-benzpyrene, and that diesel operated engines emit less 3,4-benzpyrene than carburetor operated automobiles. No 3,4-benzpyrene has been discovered in the crude oil bitumens used to pave streets in the USSR.

1506 APTIC NUMBER 12355

Kanagawa Prefecture (Japan), Public Nuisance Section
TECHNICAL REPORT ON AIR POLLUTION IN YOKOHAMA-KAWASAKI INDUSTRIAL AREA (1957-1962). Yokohama, Kanagawa Prefectural Government, 1963, 60p.

Measurements obtained in a six-year study of air pollution in the Kanagawa area of the Tokyo-Yokohama industrial zone are presented. The main cities of Kanagawa Prefecture are Yokohoma and Kawasaki which contain 70% of its 4 million population and a majority of the area's heavy and chemical industries. Results of the study concern the measurement of sulfur dioxide, suspended dust, dust fall, graphite and water soluble matter in the dust fall, and atmospheric chloride and nitrogen dioxide. Also surveyed were the effects of air pollution on visibility, corrosion, vegetation, and human health. The present status of pollution-control measures are summarized and suggestions offered for reducing soot and smoke levels.

1507 APTIC NUMBER 18080

AIR POLLUTION. THE KENT COUNTY REPORT. Mich. Occup. Health, 13(4):2-5, Summer 1968.

The Michigan Department of Health, Division of Occupational Health, conducted an air pollution study of Kent County from July 1966, through June 1967. The study was divided into three parts: Emission inventory survey, air sampling, and meteorological evaluation. The survey showed that the largest single source of air pollution in Kent County is private and commercial vehicles which contribute an average daily output of 747.3 tons of contaminants of which 744.2 tn/day are gases and 3.1 tn/day are particulates. Industry and service operations were second with 138.2 tn/day (61.1 tn/day gases, 77.1 tn/day particulates). The study findings indicate that a control program is required to curb existing pollution sources and to prevent new sources from developing.

1508 APTIC NUMBER 17550

Horik, Jozsef and Záborszky Katalin
QUANTITATIVE STUDY OF THE SEDIMENTING DUST IN THE BALATON AREA. (Az ulepedo por mennyisegenek vizsgalata a Balaton termegeben). Text in Hungarian. Egeszsegtudomany, 10(3):275-281, 1966. 7 refs.

The amount of aerosestone sedimenting on to the Balaton area was continuously measured to 10 places (6 at the water side, 4 on the water) over two years. It was found to be 27.36 tons/sq km/year. A seasonal fluctuation showing a maximum in the summer (3.5 grams/sq m/month) and a minimum in the winter (1.8 grams/sq m/month) were demonstrated, indicating that the fluctuation is the opposite of the urban fluctuation. The absolute quantity of aerosestone in the industrial towns exceeds that in the Balaton area by two orders of magnitude. (Author abstract)

1509 APTIC NUMBER 12104

Ontario Dept. of Health, Toronto (Canada), Air Pollution Control Div.
AIR POLLUTION IN FOUR ONTARIO TOWNSHIPS FRONTING THE NIAGARA RIVER 1959-1960. Preprint, 44p., 1964 (?). 8 refs.

A survey of the air pollution potential of the four townships, Bertie, Willoughby, Stamford, and Niagara, along the Niagara frontier was undertaken in 1959 - 1960. In each township, the amount of each type of contaminant emitted was estimated for all commercial, private and public, farm, and industrial sources. In this area, 67,000 tons of air contaminants are emitted annually; 88% of this is in Stamford township with 50% from the chief city, Niagara Falls. Industry alone is responsible for 82% of the total emission. Measurements of ground concentrations of dustfall, sulfur dioxide, and particulate matter at six locations indicated that the particulate loading is high in downtown Niagara Falls. Wind and temperature factors favored the dispersal of air pollutants and air movement across the frontier from Canada to the United States. (Author abstract modified)

1510 APTIC NUMBER 12484

Oya, Tatsunori, Tetsuo Kudo, Hiroshi Miyazaki, Koji Mimi, Hitoshi Hasegawa, Sadao Iki, Namio Saruta, Takeo Suzuki, Yoshitaka Kobayashi, Kiyoshi Ito, Osamu Koyama, Mototsugu Terabe, Katsumi Saruta, Hiroshi Takeuchi, Michio Nakano, and Tetsu Jujii
INVESTIGATION OF AIR POLLUTANTS. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 1(2):87-96, 1967. Translated from Japanese. 48p.

Measurements of dust and other atmospheric pollutants were undertaken in various parts of Japan. The sampling equipment and analytical methods used in individual studies and the results obtained are briefly discussed. Among the significant findings were the absence of a correlation between the time of maximum dust fall and the time of maximum air pollution in Hokkaido; the absence of significant year-to-year variations in dust fall; the discovery that the Cu, Zn, Ca, and Mg content of dust fall was relatively equal in cities where steel mills were located and in cities having no mills; and the tendency of deposited dust to be coarser in industrial areas and coarser in summer than in winter. In the Yokohama area, sulfur dioxide concentrations were highest in winter. In Otake, high sulfur dioxide concentrations and the frequency of thie occurrence were related to sea breezes. A dramatic increase was observed in the amount of 3,4-benzpyrene in dust deposits. In Tokyo, more than 75% of hourly hydrocarbon concentrations were found to range from 60 to 599 ppb; the concentrations did not decrease when traffic density was low. In Osaka, the daily cycle of mist concentration differed from that of sulfur dioxide and particulates, but was similar to that of ozone.

1511 APTIC NUMBER 17851

Parkin, D. W., D. R. Phillips, R. A. L. Sullivan, and L. Johnson
AIRBORNE DUST COLLECTIONS OVER THE NORTH ATLANTIC. J. Geophys. Res., 75(9):1782-1793, March 20, 1970. 8 refs.

Day-to-day airborne dust collections using the mesh technique on the bows of ships were made across the temperate North Atlantic. Terylene and nylon meshes were exposed as kites' 10 meters above deck level and washed in distilled water back in the laboratory. The wash water was allowed to settle overnight and the settled dust collected and again allowed to settle before siphoning, sieving, and measuring the weight per unit volume of air. In January 1969, the dust concentration (down to grain size of about 2-micron equivalent spherical diameter) was roughly constant at 0.003 micrograms per cu m between Ireland and Newfoundland; in August 1969, the concentration was greater and varied between 0.003 at Ireland and 0.01-0.03 micrograms per cu m near Newfoundland. The concentrations rise steeply in the Bay of Maine; and off Cape Cod, if the exposure intersects a stream of black city pollution, it can rise to 4 micrograms per cu m. All the dusts are gray to dark gray due to carbon and fly ash spherules. In the greater than 3-micron size fraction, the spherules alone can be 60 per cent of the sample when near the land, and usually there are about 5 per cent spherules in mid-ocean. Talc, especially abundant in the January collections, is present in the crystalline fraction of all samples. Air spreading across the ocean is estimated with the spherules used as tracers, and a pollution stream increases its width fivefold in moving from Newfoundland to Ireland. Close to the West African coast, near Dakar, the concentration of red-brown dusts is 10 micrograms per cu m with grains greater than 23 micron contributing 0.1 per cent of the total weight; at Barbados, the corresponding size decreases to greater than 11 micron with a marked fall in the percentage of quartz. (Author abstract modified)

1512 APTIC NUMBER 18083

Robinson, E. and R. C. Robbins
ATMOSPHERIC CO CONCENTRATIONS ON THE GREENLAND ICE CAP. J. Geophys. Res., 74(8):1968-1973, April 15, 1969. 7 refs.

Measurements of atmospheric CO concentrations were made at Inge Lehmann Station, Greenland (78 N, 39 W), over the period July 23-August 3, 1967. During this period CO concentrations ranged from 0.05 ppm on August 2 to a high of 0.65 ppm on July 29. The period of high concentrations occurring around July 29 coincided with the passage of an air mass which had previously traversed the Great Lakes and northeastern United States. On the basis of these limited observations, it is estimated that artic air masses passing over Greenland have CO concentrations of between 0.10 and 0.20 ppm; however, concentrations of 0.5 to 1.0 ppm can occur when the air mass has recently traversed heavily populated areas. These Greenland observations are generally comparable with other CO measurements from polar areas. (Author's Abstract)

1513 APTIC NUMBER 17715

Selezneva, Ye. S., O. P. Petrenchuk, and P. F. Svistov
DISTRIBUTION AND CHEMICAL COMPOSITION OF NATURAL AEROSOLS OVER VARIOUS REGIONS OF THE EUROPEAN SECTOR OF THE USSR. (O raspredelenii i khimicheskom sostave estestvennykh aerozoley nad raznymi rayonami evropeyskoy territorii SSSR). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 234:125-129, 1968. 24 refs.

Results of a survey conducted by the Main Geophysical Observatory, utilizing standardized procedures for studying the distribution and chemical composition of aerosols, are evaluated. Direct analysis of air samples taken at the ground and by aircraft at altitudes of 250-1000 m, together with data derived from analysis of cloud and precipitation samples, were used. Data are given for the following ions: SO4--, Cl-, HCO3-, NO3-, NH4+, Na+, K+, Mg++, Ca++.

1514 APTIC NUMBER 17560

Sladek, Ivan
CONTRIBUTION TO THE UNDERSTANDING OF THE DAILY CYCLES OF ATMOSPHERIC POLLUTION WITH SO2 IN PRAGUE. (Prispevek k poznani denniho rezimu znecisteni ovzdusi SO2 v prazo). Text in Czech. Meteorologicke Zpravy, 20(3-4):99-101, 1967. 3 refs.

Hourly averages of sulfur dioxide concentrations, measured in Prague, Czechoslovakia over a period of one year (1963-64), indicate that the volume of SO2 in the ground layer of the city's atmosphere follows a regular diurnal course, marked by a morning maximum occurring between 6 and 10 am, and evening maximum between 4 and 11 pm, and a night and afternoon minimum. The morning high occurs during the same part of the day throughout the year, and exceeds the evening peak in the spring, summer, and autumn; the latter occurs earliest during autumn and winter, later in spring, and latest in summer. Only in winter does the evening level exceed that of the morning. The morning maximum is explained by rising SO2 emissions, the afternoon minimum by an increased turbulence, the evening maximum by renewed dispersion of emissions, and the night minimum by a low level of SO2 emission. Concentrations on Sundays were lower than on the other days of the week. (Author abstract modified)

1515 APTIC NUMBER 17712

Son'kin, L. R.
ANALYZING METEOROLOGICAL CONDITIONS OF HAZARDOUS AIR POLLUTION IN CITIES. (Analuz meteorologicheskikh uslobiy opasnogo zagryazneniya vosdukha v gorodakh). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no.234:60-68, 1968. 25 refs.

Data gathered from several cities are used to examine synoptic situations related to strong and weak air pollution conditions. Special attention is given to the repeatability of three types of synoptic situations, designated as follows: 1) gradientless baric field; 2) intermediate field; 3) cyclone, as recorded at three fixed points in Magnitogorsk. Studies were based on sulfur dioxide and dust measurements and may be used to predict the distribution of impurities in city air under stagnation conditions. The results presented have been and will continue to be used to assure air purity in Soviet cities.

1516 APTIC NUMBER 12102

Welsh, G. B.
A PILOT STUDY OF AIR POLLUTION IN LYNCHBURG, VIRGINIA. Preprint, Public Health Service, Washington, D. C. and City of Lynchburg, Va. 2p., 1961.

Intensive air pollution sampling was conducted in Lynchburg, Va. for seven days, Feb. 9-15, 1961, including one weekend and one all-night sampling period. Visibility measurements to ground level objects were taken every hour. Sampling was done for oxidant, nitric oxide, nitrogen dioxide, carbon monoxide, sulfur dioxide, hydrogen sulfide, and particulate matter. The results obtained by the study should only be considered indicative of the magnitude of air pollutants. The levels found clearly indicated the Lynchburg has an air pollution problem. The soiling capacity and particulate matter levels indicated the presence of a general smoke problem. The visibility standard for ambient air of the California State Health Dept. (less than 3 miles at less than 70% relative humidity) was exceeded on 6 days. A combination of meteorological conditions including low wind speed, temperature inversion, and a haze layer at the top rim of the James River Valley was noted on Feb. 15. The highest levels for general air pollution for the entire sampling period occurred during this period and appeared to be attributable to the combined meteorological conditions. The high level of sulfur dioxide was comparable to levels found in many large population centers or highly industrialized areas. The levels for some of the gaseous pollutant were about average for urban areas; however, under conditions of low wind speed and temperature inversion, they may accumulate until much higher levels are reached. A full-time air pollution control program and rules and regulations for air pollution control were recommended. The full-time air pollution control program should include routine air quality monitoring for particulate and gaseous pollutants, an inventory and assessment of air pollution sources, a sources, a public education program, and implementation of effective air pollution control. Air pollution control districts should be established by the state legislature, and future highways and zoning requirements should seriously consider the air pollution potential.

1517 APTIC NUMBER 17551

Wisse, J. A. and C. A. Velds
PRELIMINARY DISCUSSION ON SOME OXIDANT MEASUREMENTS AT VLAARDINGEN, THE NETHERLANDS. Atmos. Environ., vol. 4:79-85, 1970. 13 refs.

Following complaints of damage to crops in an agricultural district adjacent to an industrial region of the Netherlands, monitoring program was initiated to determine if the damage was caused by photochemically produced oxidants. Measurements were made with a Mast dc ozone analyzer. Hourly values of the oxidant level obtained from June to November 1968 are summarized. The oxidant level exceeded an equivalent ozone concentration of 10 pphm by mass on 11 days. There was a stable layer below 2000 m and the sky was generally clear. The seven days during which the oxidant level remained below 3 pphm by mass were also characterized by a stable layer below 2000 m, though sunshine was negligible. During days with unstable stratification, the oxidant level did not decrease systematically, indicating that photochemical production is not restricted to the lowest 100 m of the atmosphere. An upper air inversion and bright sunshine appear to be favorable conditions for the photochemical production of oxidants; these conditions are associated with anticyclones over Central Europe. In winter, the anticyclones mean a stable stratification of the boundary layer and cold weather, conditions favoring high SO2 concentrations.

1518 APTIC NUMBER 12139

Wohlers, H. C. and H. Feldstein
AIR CONCENTRATIONS OF ORGANIC CARCINOGENS AND THEIR EFFECTS. Bay Area Air Pollution Control District, San Francisco, Calif., 16p., 1963. 36 refs.

The sources, air concentrations, and health effects of benzo(a)pyrene in the San Francisco Bay Area are reviewed. Combustion effluents are the principle sources of this compound; polynuclear aromatic compounds in general are present in biologically significant amounts in internal combustion engine exhausts. The weight of benzo(a)pyrene discharged daily into the air of the Bay Area is estimated at 3.43 lbs, which is small compared to total organic material discharged from all sources in 1958. Air concentrations of benzo(a)pyrene were also low, averaging 1.87 micrograms per 1000 cu m. In a study of eight cities, the standard benzo(a)pyrene cancer rate of equivalent dose was from 2 to 4 times higher in Birmingham (which had the highest rate) than in San Francisco, New Orleans, Cincinnati, Detroit, or Philadelphia. Air samples collected in 1958-59 showed benzo(a)pyrene concentrations about 10 times higher in Birmingham than in San Francisco. Because of a great many complicating and as yet unresolved factors, no conclusions can be made at present about the effect of benzo(a)pyrene on the etiology of lung cancer in the San Francisco Area.

1519 APTIC NUMBER 17540

Yagyu, Hiroshi
ON AIR POLLUTION IN TOKYO. (Tokyoto no taikiosen ni tsuite).

Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 7(5):1-11, Jan. 1, 1970. 12 refs.

Japan has made remarkable progress in controlling pollution levels. A 10-yr record of the density of pollutants in Tokyo indicates that dust and sulfur dioxide levels have remained stable, though carbon monoxide density has increased due to fuel gas used for heating and cooking (rather than to automobile exhausts). Carbon monoxide poisoning will occur if emissions are not controlled. The CO density is considered a representative index of other air pollutants such as nitric oxide, nitrogen dioxide, hydrocarbons, etc. In Tokyo, restrictions on SO2 emissions are in effect. However, the increasing occurrence of smog indicates the desirability of a new index. With respect to the current character of air pollution in Tokyo, it is very difficult to prove its pathological and physiological effects on the human body. On the other hand, the psychological effect is pronounced because of the influence of radio, TV, and the press. In actuality, the risks from air pollution are small compared to those from smoking.

ATMOSPHERIC INTERACTION

1520 APTIC NUMBER 11926

Barrett, E. W. and J. E. Quon
SOME EXACT SOLUTIONS OF THE EDDY-DIFFUSION EQUATION FOR GROUND AND ELEVATED POINT SOURCES. Preprint, Northwestern Univ., Evanston, Ill., Technological Inst., 40p., 1965. 9 refs.

The equation of steady-state eddy diffusion for neutrally-buoyant matter in the atmosphere was reduced to a canonical form containing an irreducible minimum of adjustable parameters by nondimensionalization and nonlinear transformations of the Cartesian coordinates. The mean wind and the vertical and lateral eddy diffusivities were represented by power-law profiles. The exponents for the first two were related by the Schmidt conjugate-power law, while that for the lateral diffusivity is arbitrary. The treatment differed from earlier investigations by the retention of the downwind diffusion term which is not negligible in comparision with the wind transport term. The resulting elliptic equations was solved for point sources at the ground and aloft with a restriction imposed on one of the two adjustable parameters. This restriction required that the exponents for the mean-wind and lateral eddy-diffusivity profiles be equal. The solution for the ground source was obtained in simple closed form. The solution for the elevated source involved an infinite series for complete three-dimensional specifications, but the ground level concentration from an elevated source had the same closed form as the concentration produced by a ground level source in a horizontal plane at the height of the elevated source. Plots of normalized concentrations as functions of the nondimensional coordinates were presented. Asymptotic forms for the solutions at great distances downwind were also derived. The effects of the restriction which was imposed to obtain a solution were discussed. It was concluded that the solutions will be most useful under conditions of high static stability, and that an unrestricted solution of the equation is needed in order to fit experimental data under all conditions. (Author abstract modified)

1521 APTIC NUMBER 17562

Baum, Fritz
WIND MEASUREMENTS IN THE FRAMEWORK OF AIR POLLUTION MEASUREMENTS. (Windmessungen im Rahmen von Luftverunreinigungesmessungen). Text in German. Meteorol. Rdsch., 20(1):3-11, Feb. 1967. 23 refs.

Within the framework of large-scale air-pollution measurements, wind measurements present difficulties; due to terrain obstructions and various building configurations, the overall air motion is disturbed. Consequently, the wind conditions vary greatly within the district in which the nominal wind measurements are made. This fact is illustrated by the extensive wind measurements carried out in the town Geislingen (Germany). Conclusions can be drawn from the data not only regarding the air pollution problems of the town of Geislingen, but also regarding the manner in which wind measurements should be carried in the context of large-scale air-pollution measurements. In some conditions, several wind measuring stations have to be established in a nominal wind-measurement district, thus creating measurement subdistricts for which the respective wind measurements are more truly representative. The establishment of several wind measuring stations involves a considerable increase in the labor of evaluation of the measured data. This can be avoided by making the wind measurements with automatic recording devices. The factors entering into the design of an automatically recording wind measuring device are discussed.

1522 APTIC NUMBER 18081

Benarie, M.
CALCULATION OF THE AMOUNT AND THE NUISANCE OF POLLUTANTS EMITTED FROM A POINT SOURCE. (Le Calcul de la Dose et de la Nuisance du Pollutant Emis par une Source Ponctuelle.) Text in French. Atmos. Environ., 3(4):467-473, July 1969. 4 refs.

A simple formula (a log-normal representation) has been developed empirically for the distribution of velocities of the wind in a direction or a given sector. With the support of the representation and that of the classical formulas of diffusion (Sutton, Pasquill, and Bosanquet) an elementary method is arrived at for calculating the frequency of the nuisance and of the amount of pollutant received at a given point by emission from a point source. (Author's Abstract, Translated)

1523 APTIC NUMBER 17774

Byzova, N. L. and K. P. Makhon'ko
INTERACTION BETWEEN AN AEROSOL AND THE UNDERLYING SURFACE. (O vzaumodeystvii aerozolya s podstilayushchey poverkhnost'yu). Text in Russian. Fiz. Atm. i Okeana (Moscow), 4(9):1000-1003, Sept. 1968. 7 refs.

The case of steady-state vertical diffusion with the concentration field uniform with respect to the horizontal and the rate of gravitational precipitation equal to zero is examineed theoretically. The analysis is applicable to precipitation of globally-produced radioactive dust and is based on tests with aerosol particles on the order of 0.3 mum and results from field studies. Computational parameters derived from these tests and studies are tabulated.

1524 APTIC NUMBER 11848

Carson, J. E. and H. Moses
ANALYSIS OF SMOKE PLUME PHOTOGRAPHS. In: Radiological Physics Division Annual Report, July 1965 to June 1966. Argonne National Lab., Ill., Contract W-31-109-Eng-38, ANL-7220, p. 89-96, 1966. 7 refs.
CFSTI: ANL-7220

Plume rise from an experimental smoke stack was recorded simultaneously by two remote-controlled 35 mm cameras at 15-sec intervals over 4-min periods. Most of the photographs were taken on clear, sunny days when the atmosphere was very stable and under conditions of maximum effluent rise. The initial concerned the behavior of a time-integrated plume, defined as the outer envelope of 16 individual photographs recorded during a 4-min period. To create a 'mean' plume, the first frame was projected by an enlarger on a sheet of paper; the outer edge of the plume, edges of the picture, stack horizon, and other identifying marks were traced on the sheet. The remaining 15 frames were then projected on the same sheet and the outer edge of any plume extending beyond the limits of the preceding frames was traced. Finally, a smooth curve outlying the two edges of the mean plume was drawn. The traces on paper were used to locate the mean plume in real space. The most obvious conclusion from the data obtained was the great variability of all plume parameters from one run to the next during intervals in which the measured meteorological conditions were nearly steady and stack speed and temperature was held constant. This means that the 4-min averaging period is too short to achieve stable mean plumes and that eddies with periods longer than 4 min are operating. Fluctuations were smaller during inversion conditions. It is concluded that conventional formulas for plume rise using temperature, wind speed, or stability data cannot be used for accurate predictions of short-term plume rise and other plume motion under unstable and neutral conditions.

1525 APTIC NUMBER 12264

Chalikov, D. V.
CALCULATION OF GROUND-LEVEL TURBULENT FLOWS ACCORDING TO SYNOPTIC INFORMATION. Meteorol. Hydrol. (English translation from Russian of: Meterol. i Gidrol.), no.8:12-24, Nov. 1968. 14 refs.
CFSTI: JPRS 46817

A method for calculating the values of the vector of turbulent friction stress and turbulent flows of heat and moisture near the ground surface using the data obtained by the daily meteorological observations is described. The method is based on the known formulas for the geostrophic coefficient of friction and heat and moisture exchange coefficients for the boundary layer of the atmosphere. Obtained on the basis of the theory of similarity. Nomograms for determining the geostrophic friction coefficient with stratification parameter S and Rossby number R sub o and for determining the angle alpha between directions of ground friction stress and wind with stratification parameter S and Rossby number are given. The results of the calculations of the nomograms are compared with empirical data. A certain conformity between the two data exists but it is recommended to verify the nomograms by independent measurement data. The described method may be used in climatological calculations, as well as in numerical computations of the general circulation of the atmosphere and long-term weather forecasts.

1526 APTIC NUMBER 12198

Changnon, Stanley A., Jr.
CLIMATOLOGY OF HOURLY OCCURRENCES OF SELECTED ATMOSPHERIC PHENOMENA IN ILLINOIS. Illinois State Water Surv. Circ. 93, 28p., 1968. 23 refs.
CFSTI: PB 179912

Climatological information pertaining to the hourly occurrences of glaze, sleet, snow, thunderstorms, hail, fog, and smoke was reported. Data from Moline, Springfield, and Evansville stations were selected for use. Because of the geographical positions, these stations provide data considered representative of certain climatic conditions in northern, central, and southern Illinois. The diurnal distribution at a point of icing conditions and snowfall, which frequently tend to occur in the same storm period, indicated the existence of significant areal variations within Illinois. The maximum and minimum times for icing conditions and snowfall were not in agreement with those for winter precipitation. The diurnal distributions of thunderstorm occurrences did not exhibit marked areal variations. All three areas of the state had a maximum in the 1900-2200 hr period, and a second maximum in the 0100-0400 hr period. This agreed fairly well with the diurnal distribution of precipitation in the warm season. Occurrences of damaging hail are at a maximum in the 1300-1900 hr period which is before the first thunderstorm maximums; but hail occurrences are at a minimum in the late morning hours when thunderstorms are least frequent. Fog, a hydrometeor, and smoke, a lithometeor, both of which produce visibility problems, also exhibit very little statewide variability in their diurnal distributions. Both phenomena are at a maximum in the midmorning hours and are at a minimum in the early afternoon. There was very little difference in the durations of sleet, thunder, and hail when they occur at a point anywhere in Illinois. However, the average point durations of glaze, snowfall, and fog varied slightly. Daily extreme of the seven atmospheric phenomena vary from no occurrences per day to 24 hours for fog and smoke. (Author summary modified)

1527 APTIC NUMBER 11695

Charlson, Robert J., Norman C. Ahlquist, and Helmuth Horvath
ON THE GENERALITY OF CORRELATION OF ATMOSPHERIC AEROSOL MASS CONCENTRATION AND LIGHT SCATTER. Preprint, Washington Univ., Seattle, Dept. of Civil Engineering, 18p., 1968. 7 refs.

A series of simultaneous mass concentration and light scattering measurements were conducted in several locations with widely varying types and amounts of aerosol. The light scattering coefficient was measured with an integrating nephelometer adapted for continuous monitoring with a 100-sec time constant; most of the aerosol samples for the mass determination were collected by filtering a measured volume of air through 2.54-cm diameter Nuclepore filters. Experimental results indicate that, at low humidity, a useful relationship exists between the light scattering coefficient of atmospheric air and the mass concentration of suspended particulate matter. The most probable value of the product of meteorological range and mass concentration is about 1.2 g/sq m, with 90% of all cases between 0.7 and 2.6 g/sq m. This result may be useful in air pollution legislation, since quantitative relationships between effects and amount of pollution are not well developed. If so, the distribution of Lv(*), the meteorological range in the absence of other extinction coefficients, times mass values suggests that

0.8 grams/sq m or slightly less would be the necessary value to assure that the best visibility for a given mass concentration would actually exist. Inasmuch as the other extinction components will decrease the visibility even further, this quantity may not be low enough. Finally, the generality of these results with respect to location suggests that the same criterion may be used in a wide variety of environmental conditions. (Author conclusions modified)

1528 1528 APTIC NUMBER 17509

Davies, R. R.
CLIMATE AND TOPOGRAPHY IN RELATION TO AERO-ALLERGENS AT DAVOS AND LONDON. Acta Allergol., 24(6):396-409, Dec. 1969. 27 refs.

Maximum concentrations of grass pollen and total fungal spores occurred earlier in the season in London than in Davos, associated with the earlier rise and sustained higher values of accumulated temperature, while maximum concentrations of basidiospores occurred earlier at Davos with an earlier onset of autumn and increased atmospheric humidities. Apart from April and October when more rain fell in London than at Davos, Davos was the wetter. Prolonged rain washes the air free from particulate matter and by wetting the surfaces of vegetation, temporarily inhibits spore dissemination. Katabatic wind produces temperature inversions, and the shorter the period between surface-inversion breakdown and its re-establishment in the valley, the shorter is the diurnal time interval during which allergens become airborne. Heating of the valley floor to a higher temperature than the surrounding mountains produces convection and rapidly rising air currents; the spore clouds which develop in a valley during the day will have a more rapid convective ascent and be diluted more rapidly than those on a plain. The average roof top concentration of Cladasporium was 27 per cent of that in the park, and the indoor and street concentrations were 7 per cent and 11 per cent respectively in London from 1963 data. The valley of Davos is too wet and cold for cereals, and lower concentrations were recorded than in London. Spore clouds collected by winds blowing over the plain region are deflected up the sides of the mountains and are then blown over their tops, and shelter is obtained in the steep-sided valleys. It is concluded that the relief of asthma in the Alps is only partly related to height, and that the mountains act as barriers and Alpine valleys are sheltered from the clouds of spore allergens developed over the plains.

1529 APTIC NUMBER 12304

Defense Documentation Center, Alexandria, Va.
ATMOSPHERIC TURBULENCE. VOL. I BIBLIOGRAPHY. DDC-TAS-66-40, 456p., Sept. 1968. 315 refs.
CFSTI, DDC: AD 678760

A selective bibliography is presented of reports on general and specific aspects of atmospheric turbulence written after 1960. An abstract is included with each citation. Predominant subjects are clean air turbulence, planetary boundary layer turbulence, and storm and cloud turbulence. Additional topics include references on spectral analyses methods, turbulent diffusion and dispersion, turbulence interaction with electromagnetic and acoustic waves, jet stream turbulence, and upper air turbulence. Entries are arranged numerically within each section by AD number. A list of AD numbers at the end of each section refers to abstract located under other headings but related to the subject of the section. Subject, personal authors, corporate author, contract number, and report number indexes are provided. The references are to unclassified reports. (Author introductions mofified)

1530 APTIC NUMBER 12186

Deland, Raymond J.
A STUDY OF ATMOSPHERIC TURBULENCE OVER A CITY (FINAL REPORT). New York Univ., N. Y., Geophysical Sciences Lab., Grants AP 00247 and AP 00413,TR-68-14, 60p., Dec. 1968. 17 refs.

Analyses were made of wind and temperature lapse rate data measured on a tower in Minneapolis-St. Paul. Hourly mean winds were computed with geostrophic wind under certain restrictions of steadiness and uniform pressure gradients. Hourly mean wind profiles were analyzed, using winds measured at 50 and 170 meters, in nearly neutral conditions. It was necessary to use the character of the wind direction trace to define neutral conditions. Velocity spectra were analyzed for 15 runs of approximately 20 minutes, recorded from a Vector-Vane at 50 meters. Most of them exhibited unusually steep slopes in the higher frequency range. Roughness lengths estimated from the mean wind profiles were of the order of several meters, considerably greater than those corresponding to the ratio of wind speed to geostrophic wind and those estimated from the turbulence results, which were of the order of one or two meters. Both the wind profile results and the turbulence spectra appeared to show considerable effects of non-homogeneity of the terrain in the neighborhood of the tower. (Author abstract modified)

1531 APTIC NUMBER 12406

Dingle, A. Nelson, Donald F. Gatz, and John W. Winchester
RAIN SCAVENGING STUDIES. (PROGRESS REPORT NO. 4). Michigan Univ., Ann Arbor, Dept. of Meteorology and Oceanography, AEC Contract AT(11-1)-1407, ORA Proj. 06867, 93p., Aug. 1968. 58 refs.
CFSTI: COO-1407-20

To determine the feasibility of tracer techniques in the study of circulations and rain scavenging processes in severe convective storms, a pilot experiment using indium as a tracer was conducted. A total of 200 gm of indium was released over a period of 21 min into the updraft feeding a relatively small convective system. The tracer was released by means of pyrotechnic flares from an airplane flying at about 3200 ft. The rainfall from the system was sampled at the ground by means of an array of samplers placed and recovered by two mobile units. Analysis of the samples compared against analyses of untagged rain samples and reagent backgrounds of indium distinctly indicates the presence of tracer indium in a reasonable distribution pattern. In a related field studies, sharp variations in the concentration of trace substances in rain water samples were observed during the passage of convective rain showers over a fixed collecting station. These changes had an approximately inverse relationship to the changes of rainfall rate observed at the same station, but detailed examination of many showers showed that the shift of phase between the concentration and rainfall-rate profiles varies from 0 to 180 deg. The continuous nature of the phase shift function suggests a continuously changing behavior of the physical processes that produce it.

1532 APTIC NUMBER 12431

Environmental Science Service Administration, Silver Spring, Md. Research Labs.
ATMOSPHERIC TRANSPORT AND DIFFUSION IN THE PLANETARY BOUNDARY LAYER. ELTH-ARL 3, 81p., Dec. 1967. 21 refs.

The study of atmospheric transport and diffusion in the planetary boundary layer, micrometerology, diffusion climatology, and the application of this work to the disposal of radioactive waste gases to the atmosphere are reported. The following items are discussed: low altitude constant volume balloon (tetroon) trajectories; natural radioactivity (radon) diffusion studies; atmospheric transport and diffusion at coastal sites; and boundary layer turbulence. Research is reported under the following headings: EBR-II (reactor) diffusion studies; deposition and effluent cloud depletion studies; radar-tetroon-transponder system; meso-micro studies; technical support to reactor projects; and computer programs. Computer programs include wind direction persistence program; precipitation duration and probability program; dye analysis program; linear least squares fitting and partial correlation program; analysis of concentration fields and display of isolines on printer; auto- and cross-correlation computations; and power spectra computations.

1533 APTIC NUMBER 12221

Estoque, Mariano A.
VENTING OF HOT GASES THROUGH TEMPERATURE INVERSIONS. Air Force Cambridge Research Center, Bedford, Mass., Atmospheric Circulations Lab., AFCRC-TN-58-623, GRD Research Notes no. 3, 13p., Dec. 1958. 9 refs.
DDC: AD-160756

The penetration of temperature inversions in the lower atmosphere by plumes of hot air was investigated as part of safety analysis in the nuclear aircraft program. Previous theoretical and experimental work on free convection was critically analyzed and applied, to provide a basis for predicting conditions under which venting is possible. A nomogram showing the relationship between the maximum height attained by a hot plume of a given heat source intensity and the temperature gradient of the environment is presented. The limitations of existing knowledge on the problem are pointed out and some recommendations for future research are made. The safe disposal of radioactive wastes could be accomplished without necessarily venting an inversion. During inversion conditions, hot gas will rise until it reaches an equilibrium height within the stable layer, and will tend to remain at this level. If the level is sufficiently high and if the inversion persists, the nuclear hazard will be relatively small; but as soon as the inversion breaks down, generally after sunrise, the pollutant, which may remain highly concentrated aloft, will be redistributed vertically by turbulent mixing, a condition sometimes termed fumigation. In such cases, dangerous concentrations may occur at ground level downwind from the source.

1534 APTIC NUMBER 12218

Georgii, H. W., D. Jost, and H. J. Schaefer
THE SPATIAL AND TEMPORAL DISTRIBUTION OF SULFUR DIOXIDE AND SULFATE AEROSOLS IN THE LOWER TROPOSHERE. (Ueber die raeumliche und zeitliche Verteilung von Schwefeldioxid und Sulfataerosolen in der unteren Troposphaere). Frankfurt Univ. (West Germany). Institut fur Meteorologie und Geophysik, Contract T483-J-203, 88p., Feb. 1968. 21 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 84p.

The vertical distribution of sulfur dioxide and sulfate ion in the open atmosphere was measured from an airplane. A continuously operating Woesthoff Ultragas-III SO_2 measuring unit was inadequate, despite several technical modifications. It was insensitive, showed interferences of water vapor, and was not suited for measuring from an airplane. Therefore, the West-Gaeke obsorption method was used. At a sampling speed of 1200 1/hr, at least 96% of the total SO_2 drawn through the reagent was absorbed. For measuring $SO_4(2-)$, the sampled air was drawn through Delbag Mikrosorban filters. If two filters were placed behind each other, the amount of $SO_4(2-)$ found in the second filter was less than 10% of the total collected $SO_4(2-)$. The data from the flights showed vertical distributions which were strongly influenced by the prevailing stability of the atmospheric layering. The measured vertical SO_2 distributions were explained by theory which represents the convective movements in the atmosphere as ascending thermal bubbles originating in the area of SO_2 emission. Measurements of the $SO_4(2-)$ concentrations indicated only a small vertical decrease. The vertical $SO_4(2-)$ distribution was fairly independent of the prevailing stability of atmospheric layers. While the $SO_4(2-)/SO_2$ ratio in surface layers is below 1, it becomes larger than 1 in loftier altitudes. An investigation into $SO_4(2-)$ producing processes and sources showed that the SO_2 -NH_3 water reaction is considered the primary contributor of $SO_4(2-)$ in the atmosphere. (Author summary modified)

1535 APTIC NUMBER 17713

Gorlin, S. M. and I. M. Zrazhevskiy
WIND-TUNNEL STUDIES OF AIRFLOW OVER RELIEF AND URBAN-STRUCTURE MODELS. (Izucheniye obtekaniya modeley rel'efa i gorodskoy zastroyki v aerodinamicheskoy trube). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no.234:45-59, 1968 19 refs.

Wind-tunnel studies of airflow over a model of an isolated hill and over complex models simulating city structures are described.

The overall flow picture was not significantly altered by Reynolds numbers in the range (5.1-31.5) times 10 to the 5th power. Increasing the turbulence of the incident flow resulted in a more uniform velocity distribution along the normal to the obstacle. Changes in incident flow turbulence had a greater effect on the flow field around complex obstacles. This experimental technique is deemed valuable for solving actual meteorological problems.

1536 APTIC NUMBER 12351

Halitsky, James, Jack Golden, Paul Halpern, and Paul Wu
WIND TUNNEL TESTS OF GAS DIFFUSION FROM A LEAK IN THE SHELL OF A NUCLEAR POWER REACTOR AND FROM A NEARBY STACK. New York Univ., N. Y., Geophysical Sciences Lab., Contract Cwb-10321, Rept. 63-2, 59p., April 1, 1963. 7 refs.

Tests were conducted in a 3-1/2 by 7 ft low-speed wind tunnel to determine the distribution of gas concentrations resulting from a gas leak in the shell of an industrial nuclear power reactor. The shell was patterned after the EBRII reactor at the NRTS at Idaho Falls. The basic tests were made on the shell alone in an adiabatic atmosphere having a logarithmic velocity profile corresponding to an average velocity profile at NRTS. Additional tests showed the effect of a uniform velocity profile, change of absolute wind velocity, inclusion of auxiliary buildings, and heating the shell. The effect of proximity of the stack top to the shell was studied briefly. The concentration around the shell was found to be strongly affected by the presence of upwind auxiliary buildings. These buildings create their own displacement fields, cavities, and wakes which, in effect, become the background flow for the shell. The general flow pattern at low elevations is very complicated. It consists, roughly, of two elements: one is a characteristic cavity vortex between the power plant and shell; the other is a smooth air stream that splits laterally around the power plant. Reynolds Numbers encountered in model testing were always higher than the critical Reynolds Number for the onset of turbulence, and turbulence was always present in the flow field. One source of turbulence is the wake downwind of an object and the other is the background flow. The relationship between the two was not clearly established.

1537 APTIC NUMBER 12219

Haugen, Duane A., James J. Fuquay, Charles L. Simpson, Charles E. Elderkin, Paul W. Nickola, and Joan Dwyer
THE OCEAN BREEZE AND DRY GULCH DIFFUSION PROGRAMS. VOLUME I. Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass., Meteorology Lab., Contract AT(45-1)-1350, Proj. 61-577, AFCRL-63-791 (1), Hanford Doc. HW-78435, 240p., Nov. 1963. 3 refs.
DDC: AFCRL-63-791 (1)

Field diffusion programs were conducted at Cape Kennedy, Florida and Vandenberg AFB, California during 1961 and 1962 to establish quantitative diffusion predictions for use as range safety tools in missile test ranges. For Kennedy, experiments were conducted in summer and winter: summer, because of the high frequency of occurrence of sea breezes; winter, because of fairly frequent cold frontal passages occurring with northerly winds and possibly frequent unstable conditions. For Vandenberg, experiments were conducted within and during the absence of the marine layer with a strong capping inversion. These were also essentially summer and winter experiments. All diffusion measurements are tabulated. The experiments are also summarized in a table according to a stability classification scheme loosely defined as very stable, moderately stable, moderately unstable, and very unstable. This table emphasizes the very high frequency of the experiments that are classified as moderately unstable, the direct result of orienting the diffusion courses to study on-shore circulation patterns. Stable conditions occur very rarely with on-shore winds at either base. It is pointed out that the strong bias toward unstable conditions is somewhat undesirable for the purpose of developing general diffusion prediction equations. The solution to this problem is contained in Volume II.

1538 APTIC NUMBER 17850

Hoidale, Glenn B. and Abel J. Blanco
TEMPORAL VARIATIONS IN THE NATURE OF ATMOSPHERIC DUST ABOVE AN INTERIOR DESERT BASIN. Arch. Meteorol. Geophys. Bioklimatol. Ser. A (Vienna), 18(1):71-88, 1970. 8 refs.

Qualitative infrared microspectrophotometric analysis (4000 to 250/cm reciprocal spectral range) of 99 six-hour samples of atmospheric dust collected during April and May 1968 at a mountain laboratory in south central New Mexico revealed a systematic, meteorologically interpretable temporal variation in the mineral constituency of the dust. The ratio of silicate clays to carbonates was high during the early morning, at times of convective activity and precipitation, and at times of cold frontal passage from the east; it was low during the afternoon and at times of convective inactivity and no precipitation. The low ratio dust is attributed to advection of fresh continental particles from the exchange layer over the adjacent basin and mountains, and the high ratio dust to advection of fresh continental particles from the western Great Plains and aged continental particles from the free atmosphere. (Author summary)

1539 APTIC NUMBER 17711

Kas'yan, N. A., T. A. Ogneva, and K. M. Terekhova
TEMPERATURE GRADIENT PATTERNS OF THE NEAR-GROUND AIR LAYER IN THE USSR. (Zakonomernosti izmeneniya temperaturnogo gradiyenta v prizemnom sloye vozdukha na territorii SSSR). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no.234: 137-151, 1968. 6 refs.

Systematic observations of the temperature gradient over the 0.5-2.0 meter air layer made at 42 locations in the USSR were examined to determine the nature of change in temperature stratification in this layer with time as related to geographic location and weather conditions. In dry regions, absolute daytime gradients reached 1-1.5 C, while in timber areas they did not exceed 0.5 C. In the prairie steppes of the European sector, gradients were somewhat lower than for the analagous Asiatic zone; in the southern regions, they were somewhat higher. The probability of high gradients increased from spring to summer, and decreased toward fall. Repeatability of gradients of greater than plus or minus 2 C was low. Highest gradients recorded were +4.5 (day) and -4.7 (night), the high gradients being observed mainly in summer. Relationships between temperature gradient and radiation balance are plotted for different regions and wind velocities.

1540 APTIC NUMBER 12190

Kumai, Motoi and Harold W. O'Brien
A STUDY OF ICE FOG AND ICE-FOG NUCLEI AT FAIRBANKS, ALASKA. PART II. Army Materiel Command, Hanover, N. H., Cold Regions Research and Engineering Lab., DA Task IV014501-B52A-31, RR-150, 14p., April 1965. 6 refs.
CFSTI, DDC: AD676 811

A study of ice fog and ice crystals made in January and February 1963 is reported, including meteorological observations and a discription of a new type of cascade impactor used in studying ice-fog nucleation in exhaust water vapor from the chimney of an electric power plant and from an automobile exhaust. Ice fog persisted only over populated areas where products of hydrocarbon combustion provide sufficient water vapor and nucleating material, and only at temperatures of -40 C or lower, although ice nucleation was observed to occur at about -20 C. Meteorological conditions, especially temperature and wind, affect the occurrence and duration of ice fog. The measured mean diameters of ice fog nuclei ranged from 0.1 to 1.2 micron for ice crystals of 5 to 22 micron mean diameter, with no apparent size relationship between a given crystal and its nucleus. At temperatures near -20 C, the ice crystals grow rather large (10-150 micron diameter) and the concentration is low, permitting good visibility. However, ice fog crystals which form at -40 C or below are smaller (2-25 micron diameter) and frequently occur in sufficiently high concentrations to drastically reduce visibility. (Author summary modified)

1541 APTIC NUMBER 12233

Lengyel, Bela A. and R. J. Romagnoli
ANALYTICAL STUDIES PERTAINING TO THE MEASUREMENT OF LIGHT ABSORPTION IN AIR. (FINAL REPORT). San Fernando Valley State Coll., Northridge, Calif., ONR Contract N00014-66-C0098, ARPA Order 306, 70p., Oct. 30, 1968. 19 refs.
CFSTI, DDC: AD 679590

Experimental methods proposed for measuring the absorption coefficient of light in air are analyzed. The calculations are primarily intended for the wavelength regions where the absorption coefficient to be measured is estimated to be of the order of 0.000000001/cm. The effects of scattering, heat conduction, and static and acoustic pressure variations are examined and are related to the problem of detecting the signals produced by the absorption of heat from the laser beam. Both pulsed and cw schemes are considered. Results indicate that for wavelength regions where alpha is less than 0.00000001/cm, it is probably possible to make absorption measurements in air using a steady laser beam and noting the static pressure increase in a sealed tube if certain conditions can be met; the static pressure rise due to a single laser pulse can probably not be measured if alpha is as low as 0.000000001/cm. An interferometer scheme also appears feasible. The measurement of the acoustic wave generated by a single laser pulse depends on the focusing of the acoustic wave and on an extremely sensitive broad-band detector. It is doubtful that this can be achieved. Finally, the absorption coefficient of the 10.6 micron CO2 laser beam was measured in air; alpha equals 1.0(plus or minus 0.2) times 0.000001/cm. (Author abstract modified)

1542 APTIC NUMBER 12357

Lovill, James E.
THE VERTICAL DISTRIBUTION OF OZONE AND ATMOSPHERIC TRANSPORT PROCESSES OVER THE SAN FRANCISCO BAY AREA. San Jose State Coll., Calif., Dept of Meteorology, NSF Grant GP-4248, Dept. of Navy Order IPR 10-64-8050-WEPS, 62p., Jan. 1968. 43 refs.

A carbon-iodine ozonesonde was used to make the first measurements of vertical ozone distribution in the lower troposphere of the San Francisco area in a series of five daily soundings from Feb. 3-7, 1967. Low-level ozone maxima were found to coincide with both the wind jet and the center (at 1000 m) of the low level subsidence inversion. Several distinct zones can be identified in the overall ozone profile up to 37 km, related to the ozone production rate and the degree of vertical mixing. A sharp increase in ozone at all levels from the surface to the lower stratosphere was observed during one 24-hr period; most of the increase could be attributed to advection from the north and injection of stratospheric air into the troposhere. The tropopause is not an absolute barrier to vertical mass transport, since ozone 'flows' penetrated it on several occasions. It is suggested that the measurement of ozone concentrations up to 2 or 3 km over the San Francisco area or the Los Angeles Basin might serve as a useful tool in studying the movement and vertical stratification of pollutants, although a greater density of data in time and in the vertical and horizontal components is needed to understand flow phenomena and mechanism of ozone penetration of the inversion. (Author summary modified)

1543 APTIC NUMBER 11762

Luna, R. E. and H. W. Church
DIFOUT: A MODEL FOR COMPUTATION OF AEROSOL TRANSPORT AND DIFFUSION IN THE ATMOSPHERE. Sandia Lab., Albuquerque, N. Mex., SC-RR-68-555, 67p., Jan. 1969. 18 refs.

In conjunction with Roller Coaster, a joint US-UK project conducted at the Nevada Test Site in 1963, a computer-programmed model for predicting atmospheric transport and diffusion of aerosols was developed. The program was a melding of a U. S. code describing gravitational fallout of a log-normal size distribution of particles in a vertically varying wind field and a U. K. code describing the dispersion of a particle cloud by atmospheric turbulence. In the program, the aerosol cloud is approximated by a series of cylindrical layers in the vertical direction characterized by a source strength, lateral diameter and thickness, and a distribution of aerosol mass with particle diameter. In turn, each layer is represented by several superposed line source elements of equisize particles to conform to the aerosol mass-diameter distribution for the layer. Each element descends at its gravitational fall rate and is transported by its mean vector wind while expanding by the action of turbulent diffusion. Deposition and/or airborne dosage is calculated at ground level on a specified circular grid of ranges and azimuths whose origin is at the initial position of the cloud. Details of the development of the unique line source equations used in the model are given, indicating the analytical method used to account for linearly changing transport direction over the length of the source. In addition, the expressions used to calculate turbulent spread, deposition, particle fall rates and transport vectors are discussed in terms of appropriate experiment and theory. Various input and output options are described which permit great flexibility in program use, either in predicting dispersal from a given cloud or in determining input necessary to produce a given result. Detailed instructions are given for preparing the input data for the program. A sample problem is used to illustrate the usefulness of the program in modeling a fairly arbitrary selection of inputs. Both the input preparation and output interpretation for the sample problem are shown in some detail. (Author abstract modified)

1544 APTIC NUMBER 17768

Mahon'Ko., K. P.
ELEMENTARY THEORETICAL IDEAS ABOUT THE WASHING OF AN IMPURITY OUT OF THE ATMOSPHERE BY PRECIPITATION. Tr. Gl. Upr. Gidromet. Sluz. Inst. Prikl. Geof. (Moscow), no. 8:26-35, 1967. 19 refs. Translated from Russian, 16p., 1968.

The processes of washing an impurity out of the atmosphere by precipitation are examined. Formulae are given for its decrease in concentration in the precipitation and in the air, depending on the duration of the precipitation. From a comparison of the theoretical curves with the experimental data, coefficients of washout are found for gases and aerosols in the cloud and in the layer of atmosphere below the cloud. The washout of almost all the gases in the composition of the atmosphere proceeds more slowly, by at least one order, than the washout of atmospheric dust. The use of integrated parameters representing precipitation washout permits a simple theoretical determination and a forecast of average washout for particular sites. Figures are presented for the dependence of the concentration of sulfur dioxide in the air on the duration of the rain. (Author abstract modified)

1545 APTIC NUMBER 12224

Makhon'ko, K. P.
DIURNAL CHANGES OF THE DUST CONTENT OF THE SURFACE LAYER OF THE ATMOSPHERE. p. 253-258, 1961 (?). 2 refs. Translated from Russian. Army Foreign Science and Technology Center, Washington, D. C., 6p., Dec. 1964.
DDC: FSTC 381-T64-47

The daily variations of fall-out of almost weightless dust were investigated in connection with increasing atmospheric concentrations of the radioactive dust that is formed when nuclear test fallout combines with soil particles. The 'labeled atoms' method was employed, and fallout at 1 m above the ground surface was automatically recorded using a simple apparatus with a clock mechanism, which wound a sticky sheet at prescribed intervals. Measurements were made in summer in a meadow with well-developed grass cover. Since the intensity of dust entrainment from the ground depends mainly on the state of the soil surface and the value of the vertical air fluctuations, which in turn are associated with the wind velocity and intensity of turbulent exchange in the surface layer of the atmosphere, continuous measurements of wind velocity and near-surface temperature gradient were also recorded. The influence of these parameters in relation to variations in dust formation and fallout are traced through different parts of the day. The term 'hysteresis of the dust content' is applied to the processes of lag in atmospheric dust content over a dusty underlying surface, and, therefore, also in the processes of dust formation on this surface; the possible causes of these phenomena are discussed.

1546 APTIC NUMBER 17323

Ministry of Health and Welfare, Tokyo, (Japan), Public Nuisance Section
A REAL SURVEY PROGRAM FOR DEVELOPMENT AND CONSOLIDATION OF 1967. (Showa 42 nendo kaihatsu seibi chiiki to chosa keikaku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(6):376-377, June 15, 1967.

A survey will study the atmospheric dispersion of pollutants by tracer techniques, to gather meteorological data, and to obtain sulfur containing gas measurements with high-volume air samplers and tape air samplers. Fluorescent particles (FP) were used in the dispersion tests, with FP generators installed on chimneys from 60 to 120 m in height. The particles were collected by rods distributed at 92 points and forming 90 deg angles. The collecting points were located at intervals of 10 km diameter and measurement points were interspersed at 6 deg intervals. Sequential development of the dispersing FP's were observed by a dram impacter arranged at 2 and 4 km points. The meteorological observations will be conducted by specialists in close contact with the National Meteorological Observation Center and the National Hygienics Laboratory. The project is also aided by the Ministry of Industry and International Trade. The areas to be surveyed are noted.

1547 APTIC NUMBER 17456

Monteith, J. L.
LOCAL DIFFERENCES IN THE ATTENUATION OF SOLAR RADIATION OVER BRITAIN. Quart. J. Roy. Meteorol. Soc. (London), 92(392):254-262, April 1966. 17 refs.

In relation to other British stations, radiation totals at Aberporth on the Welsh coast are anomalously high. On the basis of recorded sunshine, the annual mean intensity of direct radiation at Aberporth is 31 mw sq cm compared with 25 mw sq cm elsewhere. Allowing for the change of extra-terrestrial radiation with latitude, the effective transmission of the atmosphere is greatest at Aberporth and Lerwick, less at Eskdalemuir, and least at Kew, consistent with differences of air pollution. Measurements at a station installed near Aberystwyth suggest that the relatively clean air near Aberporth may be confined to a very narrow coastal strip. At Kingsway, the direct radiation per hour of sunshine increased from 21 mw sq cm in 1957 to 26 mw sq cm in 1963, reflecting the decrease of smoke in central London. Kingsway and Kew now record about the same intensity of radiation attenuated at roughly 1% per 10 micrograms cu cm of smoke. Applying this analysis to the radiation balance of Britain, previous estimates of potential evaporation in North Scotland were raised from 13 to 17 in. per year, removing most of the difference in estimated evaporation over Britain. (Author abstract modified)

1548 APTIC NUMBER 12432

Prophet, David T.
VERTICAL DOSAGE PROFILES BASED ON EDDY DIFFUSIVITIES DERIVED FROM VERTICAL VANE DATA. Metronics Associates, Inc., Palo Alto, Calif., Aerosol Lab., Contract DA-42-007-AMC-21(R), TR 101, 42p., June 7, 1963. 2 refs.

A technique was described for estimating values of vertical eddy diffusivity directly from vertical vane data by expressing the observed magnitude of the vane angle deflections as a function of time. Values for eddy diffusivity were computed at heights up to 300 feet under stability conditions varying from strong inversion to nearly adiabatic lapse. The computed eddy diffusivities increase by three orders of magnitude as the stability decreases from strong inversion to nearly adiabatic lapse. For six field trials involving elevated and surface line releases of fluorescent particles, the computed values for eddy diffusivity were used in a modified form of Pasquill's diffusion equation for infinite line sources to compute vertical dosage profiles at heights up to 750 feet and at downwind distances up to ten miles. The extent of agreement between calculated and observed dosage profiles indicates that the values for eddy diffusivity computed by this method are at least of the correct order of magnitude. (Author abstract modified)

1549 APTIC NUMBER 17786

Rikhter, B. V.
NATURAL ULTRAVIOLET RADIATION UNDER DIFFERENT CONDITIONS OF ATMOSPHERIC AIR POLLUTION. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 8:195-203, 1963.
(B. S. Levine, ed.)
CFSTI: 63-11570

Data obtained from investigations of the intensity of outdoor ultraviolet radiation in Moscow, Sobakino (34 km southwest of the capital), Noril'sk, and Magnitogorsk are reported. At Sobakino, the average annual ultraviolet radiation was 17.6 mcal, or 1.2% of the integral flow. In Moscow, average direct solar ultraviolet radiation was 6.3 mcal, or 0.84% of the integral flow. During the summer, radiation losses in Moscow averaged 60%, indicating the absorptaon of considerable amounts of ultraviolet radiation by dust and soot particles. In the transpolar industrial city of Noril'sk, ultraviolet radiation was reduced, as expected, by the long polar nights, but also by the dispersion of smoke from industrial processes. Frequently, massive air pollution prevented short wave rays from reaching the ground. In heavily polluted Magnitogorsk, natural solar ultraviolet radiation varied greatly, amounting to only 65% of the average natural solar intensity. It is concluded that changes in the intensity of direct solar radiation in individual localities are relatively slight. The differences are attributed to local pollutants and to inherent variabilities in solar ultraviolet radiation.

1550 APTIC NUMBER 17848

Sehmel, G. A.
PARTICLE DEPOSITION FROM TURBULENT AIR FLOW. J. Geophys. Res., 75(9):1766-1781, March 20, 1970. 29 refs.

Particle transport from turbulent air toward vertical surfaces is described by particle effective eddy diffusivities that are greater than the eddy diffusivities of air. A set of equations to predict these diffusivities is developed and used to compare predicted to experimentally observed particle deposition in perfect-sink-surfaced vertical tubes. Comparison shows some date scatter, but statistical tests show that deposition velocities can be correctly predicted. Eddy diffusivities are back-calculated from the deposition data, and it is concluded that the free-flight velocity is a function of the particle relaxation time and not the previously assumed function of the root-mean-square velocity. (Author conclusions modified)

1551 APTIC NUMBER 11954

Senshu, Toshio
AN ANALYSIS OF THE SURFACE BOUNDARY LAYER IN A REGION OF LAND AND SEA BREEZE. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 1(1):46-54, 1966. Translated from Japanese. 31p.

A study of the dispersion conditions for waste gas in the coastal region consisted of an analysis of the land and sea breeze, and meteorological observations of the lower atmosphere (by means of a captive balloon) to determine the characteristics of the boundary layer which forms in the region of the land and sea breeze. The height of the boundary layer that formed in the region of land and sea breeze showed a distinct diurnal variation. At sunrise, the boundary layer was 300 m high. It had developed overnight by the land breeze. Between 9 and 10 am during the switch from land breeze to sea breeze, no boundary layer could be observed. The boundary layer began to build up again from a height of 50 m to 150 m when the sea breeze began to blow. The height of the boundary layer was in close connection with the atmospheric stability near the ground surface. The maximum height of 300 m was at neutral conditions; at stable or unstable atmospheric conditions, the height was always less. The roughness of the ground was large when the wind velocity was weak, while it suddenly decreased when the wind velocity became strong. It was about 20 cm at a wind speed of less than 1 m/sec and below 5 cm at a speed of more than 2 m/sec. The frictional velocity was one-tenth as large as the wind velocity at about 1 m above the ground.

1552 APTIC NUMBER 16771

Smith, L. P. and H. E. Hugh-Jones
THE WEATHER FACTOR IN FOOT AND MOUTH DISEASE EPIDEMICS. Nature, 223(5207):712-715, August 16, 1969. 4 refs.

Four epidemics of foot and mouth disease have been studied in relation to meteorological conditions prevalent during the epidemic period. Circumstantial evidence points to the hypothesis that the spread of the disease is dependent on wind and rain conditions. The airborne particles are carried in a downwind direction, being subject to diffusion processes which induce horizontal and vertical spread. Wind directions, frequency of rainfall, and epidemic intensity were used as a basis for analysis. Verifications of the findings will depend on experiments in the field during an epidemic.

1553 1553 APTIC NUMBER 17487

Smith, R. M., P. C. Twiss, Roland K. Krauss, and Merle J. Brown
DUST DEPOSITION IN RELATION TO SITE, SEASON, AND CLIMATIC VARIABLES. Soil Sci., 34(1):112-117, Jan.-Feb. 1970. 10 refs.

Mean monthly dust deposition into standard traps for 14-37 months at locally non-dusty sites east of the Rocky Mountains ranged from 17-459 kg/ha (15-410 lb/acre). Analysis of variance for 13 sites over 27 months showed significant differences in dust rates, pH, oxidizable matter, and percent clay for sites and for months. Some late fall and winter months showed significantly lower rates than spring and summer. The silt plus sand fraction tended to be lower and the percentages of oxidizables were higher for low deposition rates and eastern sites. In general, pH decreased from west to east. Grass phytoliths were prominent. Illite and kaolinite were dominant over montmorillonite in clay fractions. Correlation analysis showed positive relations between dust deposition rates and some power of average monthly wind velocity, either near the stations or for western Kansas winds. Rainfall parameters tended to correlate positively with dust catch at most stations and at all stations combined, suggesting that considerable sediment is carried down by rainfall. Deposition rates were positively correlated among sites. Multiple regression equations based on wind, rainfall, and season parameters proved useful for predicting month dust deposition at several sites. (Author abstract modified)

1554 APTIC NUMBER 17766

Tait, G. W. C.
RISE OF BUOYANT GASES RELEASED FROM INTERMITTENT SOURCES. J. Appl. Meteorol., 8(4):523-526, Aug. 1969. 4 refs.

Intermittent release of contaminated bouyant gases is considered as a means of reducing pollution of surface air. A model is proposed for large instantaneous point sources which predicts the height of rise to be greater than that obtained by release from a conventional stack as a continuous source. The model also predicts that there should be no appreciable transfer of contaminated gases from the rising cloud to the environmental air below the final height of rise. The model is insensitive to wind speed and appropriate to large-scale conditions. It is based on the existence of large and sharply defined density gradients where it is assumed that the cloud grows chiefly by incorporation and invasion through its upper boundary and that mixing through the side wall and base is so slow as to be negligible. This strong buoyant forces model is presumed to apply when the energy changes involved in any mixing of the buoyant gas and the surrounding air are large compared to the energy associated with the natural turbulence and velocity gradients within the ambient air. The model can be applied to industrial pollution control if a mass of warm contaminated air is retained by some storage device until it can be released as a single cloud of considerable total buoyancy. The application of intermittent release to the removal of polluted air from the surface is probably restricted to large industrial sources that can economically justify the construction costs of the necessary large holding vessels.

1555 APTIC NUMBER 17580

Thomas, F. W., S. B. Carpenter, and W. C. Colbaugh
RECENT RESULTS OF MEASUREMENTS. PLUME RISE ESTIMATES FOR ELECTRIC GENERATING STATIONS. IV. Phil. Trans. Roy. Soc. London, Ser. A, vol. 265:221-243, 1969. 11 refs.

Starting in 1963, the Tennessee Valley Authority collected and analyzed data for documentation and definition of plume rise and related meteorological parameters at generating plants with unit ratings from 173 to 704 MW and stack heights from 76.2 to 182.9 m. Plume rise data plotted against calculated values of all formulas used in this report indicated that the wind speed and heat emission rate are the principal determinants in calculating plume rise. The effect of the stack height on plume rise is inherent in the stability factor for this analysis. When plume observations were plotted against calculated values according to the formulas originally presented, the simple Concawe formula provided the best fit. The equations used can be summarized as plume rise equals A/u(a), where A is some function of the kinetic and thermal energy of the plume and u is the wind speed. The Concawe formula is considered preferable for general investigation because of simplicity and ease of calculation. But when a particular event, such as inversion breakup or limited mixing layer fumigation, is being analyzed, use of the 'two-thirds power law' is considered preferable, provided information for the meteorological parameters is available. This relation embodies the principal physical quantities normally associated with plume rise and permits some accounting for up to 15% difference in plume rise attributable to variation in atmospheric stability. The study served to validate plume rise formulas which can be effectively over a range of meteorological and operational conditions. (Author conclusions modified)

1556 APTIC NUMBER 16584

Thomas, Moyer D., George R. Hill, and John N. Abersold
DISPERSION OF GASES FROM TALL STACKS. Ind. Eng. Chem., 41(11):2409-2417, Nov. 1949. 12 refs.

The theoretical equations of Bosanquet and Pearson and Sutton for the dispersion of smoke from factory chimneys were solved in terms of the conventional units of the smelting industry for the elimination of sulfur dioxide from four smelters. A large mass of field data for sulfur dioxide in the atmosphere, obtained by means of automatic recorders, was evaluated in the form of Cu to M ratios, where C is the field concentration, M is the mass emission of sulfur from the plant, and u is the wind velocity. The data for tall stacks at Selby, Calif., Tacoma, Wash., Garfield, Utah, and El Paso, Tex., agreed well with the theoretical equations, when values of the diffusion coefficients of 0.05 to 0.07 are used and the exponent of the distance, x, in Sutton's equation is 2(n equals 0). A somewhat smaller exponent may be needed to satisfy the data for the short stacks at Selby and El Paso. The Theoretical curves and confirming data illustrate the beneficial effects of use of tall stacks in dispersing air contaminants from factories. Maximum ground concentration varies inversely with square of stack height. This results in lower peak and lower average concentrations from the tall stack and higher percentages of time when air is free of contamination. High temperature of smoke elimination increases effective stack height and improves dispersion. (Author abstract modified)

1557 APTIC NUMBER 17438

Valko, Peter
THE PROPERTIES OF ATMOSPHERIC AEROSOLS IN THE SOUTHERN FOOTHILLS OF THE ALPS. (Ueber das Verhalten des atmosphaerischen Dunstes am Alpensuedfuss). Text in German. Arch. Meteorol., Geophys., Bioklimatol., Ser. B., vol. 12:458-474, 1964 (?). 12 refs.

The results of four years of actinometric measurements taken 380 m above sea level at the observatory Locarno-Monti (Switzerland) were used to calculate turbidity parameters according to the method by Schuepp. The three parameters of alpha, B, and W were obtained with this method for the quantitative characterization of atmospheric turbidity. The total number of aerosols is expressed through B; the size distribution is expressed through alpha; the total content of precipitable water in the air is expressed through W. The most striking features of the results are a turbidity increase in the morning and a seasonal shift of the daily turbidity maxima. In accordance with Schmidt's theory of vertical mass exchange, the yield of nuclei sources near the ground follows an exponential law. Frequency curves for the turbidity coefficient are skewed on the left side in all seasons. Based on certain features of the diurnal variation of parameters alpha and B, a classification into four types is given: parallel characteristic of the two diurnal variations; antiparallel characteristic, where a decrease of alpha is coupled with an increase of B and vice versa; continuous change of B, with a smooth variation of alpha; and marked variation of B, with a rapidly varying alpha.

1558 APTIC NUMBER 11863

Vaughan, L. M.
FURTHER ANALYSIS OF INTERMEDIATE-SCALE AEROSOL CLOUD TRAVEL AND DIFFUSION DATA FROM LOW-LEVEL AERIAL LINE RELEASES. Metronics Associates, Inc., Palo Alto, Calif., Aerosol Lab., Contract DA-42-007-AMC-21(R), TR-117, 121p., June 2, 1965. 14 refs.

Five low-level aerial line releases of fluorescent particle (FP) tracer material were made on the Aerial Spray Grid in Utah. These trials were analyzed using vertical eddy diffusivities derived from estimates of the vertical flux of heat. Further analyses were made on the vertical distributions of dosage obtained from tower and balloon supported samplers in order to compare them with vertical standard deviations of dosage computed from the intensity and scale of turbulence as used in the Smith-Hay equation and to compute empirical values of vertical eddy diffusivity. The values of eddy diffusivity were correlated with wind speed and cloud cover. The trajectories of aerosol clouds from low-level aerial releases over flat or rolling terrain may be predicted from wind speeds near release altitude. The vertical distributions of aerosol may be predicted from turbulence parameters measured directly or derived from estimates of the vertical flux of heat. The maximum ground-level dosage from an aerial line release depended primarily upon release altitude and mean wind speed but vertical displacements caused by the aircraft and by large eddies and atmospheric waves produced large variability in ground-level dosage. The distance to maximum ground-level dosage depended primarily upon wind speed and stability, except releases as low as 100 ft, where the downdraft from the aircraft was dominant. The distance to maximum dosage appeared to be greater over smooth terrain than over rolling terrain. This result may be caused by the breakup of large eddies over rolling terrain due to mechanical turbulence generated at the surface. The large eddies produce rapid vertical diffusion, although mixing is less uniform. High wind shear produced elongation and acceleration in the downwind direction. Except for very low altitude releases, the error in dosage estimates from using a mean wind speed was negligible in comparison with other sources of error. (Author summary modified)

1559 APTIC NUMBER 17769

Vvedenskaja, L. I. et al
SOME CHARACTERISTICS OF THE METEOROLOGICAL AND AEROSYNOPTIC CONDITIONS UNDER WHICH NOVOSIBIRSK IS SCREENED WITH SMOKE. Tr. Nauchn.-Issled. Inst. Aeroklimatologii, vol. 48:177-182, 1967. 7 refs. Translated from Russian by T. C. Harwick, 7p., 1968.

The results are given of an analysis of a 10-year series of observations of city smoke at three stations in Novosibirsk. Under Siberian meteorological conditions, the formation of a long-lasting total 'smoke-screen' is most likely in a stable, low-gradient field in the presence of stable surface inversions and light winds at ground level and in the troposphere (1.5-2.0 km). Observations on nitrogen oxides showed that on days with precipitation, 54% of the sampling tests gave a concentration exceeding established permissible limits; thus, the commonly accepted idea of air cleaning by washout is considered valid only in relative terms. The location of residential and industrial building in Novosibirsk occurred without regard to meteorological factors; a large part of the residential area therefore suffers from atmospheric pollution. (Author conclusions modified)

1560 APTIC NUMBER 12229

Wagner, Norman K.
A TWO-DIMENSIONAL, TIME DEPENDENT NUMERICAL MODEL OF ATMOSPHERIC BOUNDARY LAYER FLOW OVER INHOMOGENEOUS TERRAIN. In: Theoretical Studies of the Atmosphere Boundary Layer. (Final Report). Hawaii Univ., Honolulu, Hawaii Inst. of Geophysics, Grant DA-AMC-28-043-64-G-2, TASK 1VO-14501-B53A-08, HIG-66-16, p. 1-80, Aug. 1966. 47 refs.

A two-dimensional, time dependent numerical model of the atmospheric boundary layer is formulated and used to investigate various characteristics of air motion when a change occurs in the roughness of the underlying terrain. The model assumes a dry adiabatic atmosphere and adiabatic changes of state, no dynamic pressure effects due to flow accelerations, and no vertical displacement of the zero-velocity level at the lower boundary when a discontinuity in surface roughness is encountered. Numerical evaluation of all terms in the resulting equations shows little change in the computed field of velocity if an incomprehensible atmosphere is assumed and horizontal mixing is neglected. A computational stability analysis is made which provides the relationship between time-step and grid spacing necessary to insure convergence of the numerical solution. For horizontally homogeneous conditions, comparison of the numerical solutions with various analytical solutions shows that the errors inherent in the finite difference formulation can be reduced to any desired level by reducing the grid spacing, particularly near the lower boundary. Computed qualities include the two-dimensional distribution of horizontal velocity, vertical velocity, and eddy shearing stress. Increasing surface roughness causes a decrease in the horizontal velocity near the lower boundary. This results in upward vertical motion. The computations also show that a nearly logarithmic wind profile with associated constant shearing stress becomes established throughout a layer which increases in depth with distance downwind from the roughness discontinuity. Suggestions are made for generalizing and improving the model. (Author abstract modified)

1561 APTIC NUMBER 17366

Walsh, John D.
METEOROLOGICAL FACTORS IN PLANT SITING: AN OVERVIEW. Air Pollution Control Assoc., Pittsburgh, Proc. Air Pollution Control Assoc. Mid-Atlantic States Sect., Semi-Annu. Tech. Conf., Philadelphia, Pa., 1969, p. 62-69. (March 21.)

At the present time, industry, with one exception, does not place meteorological or environmental considerations on the same level as more immediate economic factors in considering plant siting. The exception is the nuclear industry, where every facet of siting, construction, and operation is carried out under stringent review conditions. Meteorology is an important factor in plant siting, and one which deserves attention if only to the extent of assuring those parties concerned that local meteorology is no impediment to profitable operations or good community relations. Where the meteorology of an area is of primary importance, meteorological factors must be considered on an equal footing with other siting factors. The justification of this approach arises from the current state of development of air pollution control techniques and devices. If a site meets all the requirements except for an unfavorable meteorological situation, a favorable environment can still be secured by the installation of high stacks or efficient control devices, or the purchase of large amounts of land.

1562 APTIC NUMBER 17714

Yeleseyev, V. S.
SMOKE STREAM STRUCTURE AND DETERMINATION OF TURBULENT MIXING COEFFICIENT IN TERMS OF VERTICAL CONCENTRATION DISTRIBUTION. (Issledovaniye struktury dymovoy strui i opredeleniye koeffitsiyenta turbulentnogo peremeshivaniya po vertikal 'nomu raspredeleniyu kontsentratsiy). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no.234:95-99, 1968. 7 refs.

The use of helicopters to study plume behavior is considered, and experiments at Krosnoyarsk using the MI-1 helicopter to detect hydrogen sulfide and carbon disulfide are reported. A method for calculating the vertical coefficient of turbulent mixing in terms of concentration distribution is presented and compared with experimental results.

BASIC SCIENCE AND TECHNOLOGY

1563 APTIC NUMBER 17261

Adachi, Takayoshi
ON THE BEHAVIOR OF PARTICLES IN THE ELECTROSTATIC PRECIPITATOR. (Denkishujinki naino ryushi no kyodoh nitsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(6):405-411, July 15, 1966. 6 refs.

A theoretical study was made on the behavior of charged particles in the field of corona discharge. The theory was developed on the assumption that the sum of the Coulomb force in the electrostatic field and the image force with respect to a grounded electrode are equal to the damping force of gravity acting on the particle due to the tension of a string, which suspends the particle. The agreement between the theoretical and observed values was excellent. A considerable amount of ion wind was observed, but its effect on the measured results was negligible. When the electroconductive particles were attracted close to the precipitator electrode, they oscillated with a small amplitude, keeping a small discharge gap with the electrode. An equilibrium of the electrical charge was maintained without the adhesion of the particles to the electrode. No change was observed in the spark gap, even when the corona discharge voltage was fluctuated. The insulator particles jumped around when the corona voltage was low. The particles, however, completely adhered to the electrode when the voltage was elevated. When the discharge capacity of the contract surface was small, a glow discharge discharge was maintained along the surface. A theoretical analysis is being made on the behavior of the electroconductive particles.

1564 APTIC NUMBER 12309

Altshuller, A. P., S. L. Kopczynski, D. Wilson, W. Lonneman, and F. D. Sutterfield
PHOTOCHEMICAL REACTIVITIES OF N-BUTANE AND OTHER PARAFFINIC HYDROCARBONS. Preprint, Public Health Service, Cincinnati, Ohio, National Air Pollution Control Administration, 17p., April 1969. 11 refs.

Photooxidation of the n-butane - nitrogen oxide system was studied in a 335-cu ft chamber with a 6-hr., static irradiation period; methane, ethane, acetylene, propane, and several of C5 to C9 paraffinic hydrocarbons were investigated in somewhat less detail. N-butane is a major component of vehicular exhaust and evaporative losses. Maximum oxidant yields occurred at much lower ratios of hydrocarbon to nitrogen oxide than in more reactive systems such as propylene - nitrogen oxide mixtures. Appreciable oxidant yields were obtained even from irradiation of propane - nitrogen oxide mixtures at low ratios of nitrogen oxide to propane. These results and the nitrogen dioxide and oxidant dosages computed from these measurements substantiate the importance of reactivity characteristics in formulation of decisions on control of hydrocarbons and nitrogen oxides, and suggest that nitrogen oxide control is not as effective as hydrocarbon control in reducing atmospheric oxidant levels. Concurrent control of oxidants and nitrogen dioxide may prove incompatible with photochemical behavior and practical control technology, necessitating a compromise on the basis of the relative biological benefits of control of ozone and NO2. The generation of oxidant from ethane and propane mixtures of NOx at low NOx/HC levels indicates the need for determining the origin of the bulk of the hydrocarbons in urban atmospheres.

1565 APTIC NUMBER 12138

Altshuller, A. P. and Stanley F. Sleva
THE RAPID CONVERSION OF NITRIC OXIDE TO NITROGEN DIOXIDE IN THE PHOTOOXIDATION OF ORGANIC COMPOUND NITRIC-OXIDE MIXTURES. Preprint, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, Lab. of Engineering and Physical Sciences, 10p., 1963 (?). 11 refs.

The formation of nitrogen dioxide as a function on irradiation time was measured in the presence of various organic substances, oxygen, and ultaviolet radiation. Colorimetric analyses were performed at intervals during irradiation of plastic bags containing mixtures of nitric oxide and the organic compound; irradiation was continued until the NO2 passed through a maximum concentration and then began to decrease. The formation of ozone and other organic peroxy compounds was also measured by means of oxidation of the iodide ion to triiodide ion in neutral solution. Oxidation rates of 0.005 to 0.007 ppm/min were obtained both in the dark and in the presence of ultraviolet radiation, when measured at 3 ppm of NO and 200,000 ppm of oxygen. The effects of various organic species under different light conditions are discussed. The photolysis of NO2 increased with an increase in radiation intensity; but the rate of conversion of NO to NO2 also increased. Considerable additional experimental work is necessary, but results to date indicate that the rapid conversion of NO to NO2 and oxidant formation are not limited to olefins, as previously believed by some investigators.

1566 APTIC NUMBER 16581

Arai, Yasuo, Hiroshi Takenouchi, and Shoichiro Nagai
REACTIONS BETWEEN CAO AND SO2. I. ABSORPTION MECHANISM OF SO2 INTO QUICK LIME. (CaO and SO2 to no hanno. Seisekkai no SO2 kyushu kiko (dai 1 ho)). Text in Japanese. Sekko to Sekkai (Gypsum Lime), no. 44:5-11, 1960. 14 refs.

The action of combustible sulfur in coal when heated was studied. The equilibrium of the CaO-SO2 system was studied at various temperatures to determine the absorption mechanism of sulfur dioxide into quick lime. Pure sulfur dioxide gas, in excess, was introduced above a powder sample of calcium dioxide which was prepared by calcination of pure calcium carbonate at 1000 C, and put in the center of a heating tube maintained at the necessary temperature. The velocity of the gas was maintained at 200 cc per minute. The reaction products between the solid and gas phases were investigated by chemical analysis and X-ray powder patterns. The absorption velocities of SO2 into quick lime were measured about Kuzuu and Akasaka products. The results showed that the

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amount of combustible sulfur is variable with the type of coal. Sulfur is easily oxidized to sulfur dioxide and volatilized with the other combustion gases by firing of coal between 600 to 800 C under leading of air. Calcium sulfite is produced by the reaction CaO + SO2 yields CaSO3 over 400 C. With an increase in temperature, the amount of calcium sulfate increases by the decomposition of calcium sulfite at 800 C, the equilibrium between calcium oxide and sulfate is formed so that both sulfite and sulfide completely convert to sulfate upon contact with air. The semi-stable zone of sulfite and sulfide extended from 400-800 C. Beyond 1000 C, calcium oxide loses the fixative ability to sulfur dioxide gas. The decomposition reaction then is 2CaSO4 yields 2CaO + SO2 + 2O2. It was concluded that the original characters and calcining conditions of limestone as material have a large effect to the absorption velocity of gases into quick lime as a product. (Author abstract modified)

1567 APTIC NUMBER 17563

Asinger, Friedrich, Walter Schmidt, and Franz Ebeneder
PRODUCTS OF THE JOINT ACTION OF SULFUR DIOXIDE AND CHLORINE ON ALIPHATIC HYDROCARBONS IN ULTRAVIOLET LIGHT. 1ST COMMUNICATION: PRODUCTS OF THE JOINT ACTION OF SULFUR DIOXIDE AND CHLORINE ON PROPANE DISSOLVED IN CARBON TETRACHLORIDE. (Zur Kenntnis der Produkte der gemeinsamen Einwirkung von Schwefeldioxyd und Chlor auf alipathische Kohlenwasserstoffe im ultravioletten Licht, I. Mitteil.: Die Produkte der gemeinsamen Einwirkung von Schwefeldioxyd und Chlor auf Propan in Tetrachlorkohlenstoffloesung). Text in German. Chem. Ber., vol. 75B:34-41, 1942. 18 refs.

The reaction products were determined of the joint action of chlorine and sulfur dioxide on propane in a carbon tetrachloride-solution at room temperature exposed to ultraviolet radiation. Two and one-half (volume) parts of propane, 1.1 parts of Cl and 1 part of SO2 were dissolved in CCl4 in a quartz tube irradiated by a mercury-vapor lamp. After completion of the reaction, CCl4 was distilled off and the reaction product remained in the residue, from which a liquid mixture of propane monosulfochlorides, chloropropanemonosulfochlorides, dichloropropanemonosulfochlorides, and a few higher chlorination products of propane were distilled off under reduced pressure. The remaining non-distillable residue was a propane disulfochloride which melted at 48 C after being purified by crystalization from chloroform-carbon-tetrachloride mixtures. The distilled off propane monosulfochlorides (C3H7O2ClS), after additional purification were found to be 1:1 mixtures of the isomers: propane-1-sulfochloride and propane-2-sulfochloride with a boiling point at 72 to 79C. From these a 1:1 mixture of the isomers: propane-1-sultamide and propane-2-sulfamide (C3H9O2NS) with a melting point at 238 C was obtained by a specified procedure. The propane disulfochloride (C3H6O4Cl2S2) is definitely the propane-1.3-disulfochloride from which propanedisulfamide (C3H10O4N2S2) melting at 173 C and propanedisulfanilide (C15H18O4N2S2) melting at 130 C were obtained by specified procedures. For verification of the above findings all of the above compounds were synthesized by purely chemical methods. In the course of this work, propane-1-sulfanilide, and propane-2-sulfanilide were produced which are still liquid at -10 C.

1568 APTIC NUMBER 17510

Baddour, Raymond F., Michael Modell, and Robert L. Goldsmith
THE PALLADIUM-CATALYZED CARBON MONOXIDE OXIDATION. CATALYST 'BREAK-IN' PHENOMENON. J. Phys. Chem., 74(8):1787-1796, April 16, 1970. 15 refs. Grant GP-607

The break-in period for carbon monoxide oxidation over pressed-disk catalysts of silica-supported palladium was investigated, and kinetic parameters and infrared spectra of absorbed CO were monitored. The reaction was interrupted at various stages of break-in, and spectra of chemisorbed CO at 35 deg were determined in the absence of oxygen. Break-in did not begin until the catalyst was exposed to O2. For a stabilized catalyst, the apparent activation energy was 15 kilocalories per molecular weight lower and the apparent pre-exponential a factor of 10 to the 7th power lower than the values observed prior to break-in. Break-in phenomenon was interpreted as arising from a redistribution of surface structures resulting from surface diffusion of palladium. (Author abstract modified)

1569 APTIC NUMBER 17796

Balej, J. and A. Regner
THE SYSTEM SULFUR DIOXIDE-DIMETHYLANILINE I. THE ABSORPTION ISOTHERMS. (Das System Schwefeldioxyd-dimethylanilin I. Die Absorptionsisothermen). Text in German. Collection Czech. Chem. Commun. (Prague), vol. 2 1545-1552, 1956. 8 refs.

Absorption isotherms of sulfur dioxide in n,n-dimethylaniline (DMA) were determined using purified commercial DMA, SO2 gas, and N2 by the method in which SO2 + N2 gas mixtures with known SO2-content were bubbled through a jar filled with DMA at the temperature of 15, 20, 25, and 40 C until saturation, as determined by continuous analyses of the gas and the liquid phase. The amount of SO2 absorbed by DMA at saturation, X(SO2), is expressed as a mole ratio (moles of SO2/mole of DMA) and the SO2-content of a gas mixture is expressed in terms of the fugacity, f(SO2), in that mixture at the test temperature and test pressure (which was close to ambient in all tests). According to the rule of Lewis and Randall, f(SO2) equals X(SO2g). P. gamma (SO2g), where X(SO2g) is the mole fraction of SO2 in the SO2 + N2 gas mixture, P equals 1 atm is the total pressure, and gamma (SO2g) is the fugacity coefficient of SO2 gas at 1 atm which is 0.9862 at 15 C, 0.9865 at 20 C, 0.9867 at 25 C and 0.9881 at 40 C. The partial pressures, p(SO2g), of SO2, in the SO2 + N2 gas mixture corresponding to these fugacities are also given and varied between 0 and 0.33 atm. A detailed thermodynamic analysis of the test data lead to the conclusion that the SO2 absorption by DMA proceeds in two stages; first, the SO2 gas dissolves in the DMA liquid; it then interacts chemically with it to form the addition compound C6H5N(CH3)2.SO2 which, being a liquid at the test temperature, remains in solution in the excess of DMA liquid. From the absorption isotherms of the given test temperatures, the equilibrium constant of formation K of this compound was calculated, considering the contribution of the process of dissolution of SO2 in DMA as neglible in comparison with that of the chemical reaction, as equal to: 40.32 at 15 C, 25.67 at 20 C, 16.2 at 25 C, and 5.37 at 40 C.

1570 APTIC NUMBER 17803

Barde, Rene, Andre Neuze, Jacques Dubois, and Jacques Millet
EQUILIBRIUM DIAGRAM OF THE SOLID AND LIQUID PHASES OF THE SYSTEM: POTASSIUM SULFATE-POTASSIUM CARBONATE. (Diagramme d'equilibre des phases solide et liquide du systeme sulfate de potassium-carbonate de potassium). Text in French. C. R. Acad. Sci. Paris, Ser. C, 265(15-25):1257-1260, Nov. 27, 1967. 16 refs.

Within the framework of physiocochemical studies of the process of open-cycle magnetohydrodynamic conversion, a more accurate determination of high-temperature properties of alkali-metal compounds was begun by determining the equilibrium diagram of the liquid and solid phases of the system potassium carbonate-potassium sulfate in an atmosphere of carbon dioxide. Both direct and differential thermal analysis were used. In the former, the temperature of specimens with different K2SO4 contents weighing about 50 grams was measured with a Pt-Pt.Rh (with 10% Rr) thermocouple, the readings of which were recorded by a galvanometric recorder. In the latter, specimens weighing about 0.1 grams placed in a Pt crucible, together with two Pt crucibles filled with calcined Al powder, were protected by an alumina tube placed in an electric furnace. A galvanometric XY recorder recorded the difference T between the specimen and the calcined Al powder temperatures as a function of the temperature of the calcined Al powder. In all cases, an atmosphere of CO2 at ambient pressure was used. The phase diagram of the system K2CO3-K2SO4 with K2SO4 content expressed in terms of mole % and containing the measured data is given. The melting points of pure K2CO3 and pure K2SO4 were measured as 901 plus or minus 3 C or 902 plus or minus 3 C and 1069 plus or minus 3 C or 1070 plus or minus 3 C, respectively. Both, the liquidus and the solidus are continuous within the entire composition interval, showing that the components are completely intersoluble, both in the liquid and in the solid phase.

1571 APTIC NUMBER 17716

Baume, Georges and Georges -P. Pamfil
QUANTITATIVE INVESTIGATIONS OF VOLATILE SYSTEMS: FUSIBILITY CURVES OF SYSTEMS FORMED BY HYDROCHLORIC ACID AND SULFUR DIOXIDE WITH METHYLALCOHOL; MECHANISM OF THE FORMATION OF ESTERS. (Recherches quantitatives sur les systemes volatils: Courbes de fusibilite des systemes formes par l'acide chlorhydrigue et l'anhydride sulfureux avec l'alcool methylique; mechanisme de la formation desesters). Text in French. J. Chim. Phys., vol. 12:256-269, 1914. 25 refs.

The solidification of the following binary systems were determined: CH3OH-HCl; C2H5.CO2H-CH3OH, (C2H5CO2H.HCl)-CH3OH; (CH3OH.HCl)-C2H5CO2H; CH3OH-SO2; and SO2-HCl. The objective of these determinations was to obtain new confirmations on the mechanism of chemical reactions. The existence of the following, but unstable, intermediate addition compounds was established: a) CH3OH+HCl; b) CH3OH+C2H5CO2H+HCl; c) CH3OH+SO2; and d) 2CH3OH+SO2. Compounds a and b may be considered as the first stages of formation of the halogen derivatives of alcohols and esters. Moreover, compound b offers a particularly simple example of chemical catalysis by inorganic acids. In contrast with 'physical catalysts' which raise artificially and locally the temperature or pressure and thus create a state of affairs which an overall rise of temperature or pressure would produce without their intervention, 'chemical catalysts' form addition compounds with the substances whose mutual reaction they fercilitate or provoke. Compounds c and d solidifying respectively at about -71 C and about -81 C form a part of a system with a simple 'oxonian' phase diagram, in which they alternate with eutectic points at about -88 C at 45 mole % CH3OH, at about -91.5 C at 62 mole % CH3OH and at about -106 C at 89 mole % CH3OH. The SO2-HCl system has a simple eutectic point at -133.5 C at 80 mole % SO2.

1572 APTIC NUMBER 17493

Bezuglyi, V. D., L. V. Kononenko, A. F. Korunova, V. N. Dmitrieva, and B. L. Timan
EFFECT OF STRUCTURE AND MEDIUM ON THE POLAROGRAPHIC ACTIVITY OF AROMATIC SCHIFF BASES. J. Gen. Chem. (USSR) (English translation from Russian of: Zh. Obshch. Khim.), 39(8):1647-1651, Aug. 19, 1969. 14 refs.

Values of half-wave potential are affected by substituents both in the 'amine' and 'aldehyde' benzene ring of the N-benzylideneaniline molecule when investigated in aqueous-alcoholic media by the polarographic method. For substituents in the 'amine' benzene ring, there is a break in the curve for the relation of E 1/2 to sigma from electron-donor to electron-acceptor substituents, and the break is explained by a change in the nature of the reaction center in the electrochemical reduction reaction due to difference in the interaction of the p-electrons of the nitrogen of the CH double band N group with the solvent.

1573 APTIC NUMBER 17802

Bier, K., Wilfried Fischer, G. Dickel, and H. G. Moeller
ISOTOPE SEPARATION AND ENRICHMENT. Chem. Ing. Tech., vol. 34:580, 1962. 10 refs. Translated from German by L. L. Smith, Du Pont de Nemours (E. I.) and Co., Aiken, S. C., Savannah River Lab., 4p., Sept. 6, 1963.

Methods of isotope separation and enrichment are reviewed. In the United States, England, and the Soviet Union, enrichment of U235 is carried out on a technical scale by the partition diffusion method. Since investment costs decrease with increasing absolute pressure, the economy of this method is determined chiefly by the properties of the partition. It should have the narrowest possible pores, a large gas permeability, and adequate mechanical stability for a pressure difference of 0.5 to 1 atm. Other possibilities for efficient separation of uranium isotopes are the gas diffusion method, which depends on the separation of variously heavy components in a gravitational or centrifugal field, and the partition jet method, which depends on the separation of different weights of components in the stationary pressure gradient of a freely expanding gas jet. There is not enough data about the operation of partition cascades to estimate the investment costs of the gas centrifuge method. In the case of U235, investment costs for the partition jet method are higher than for the partition diffusion method. Enrichment of Ca46 can be achieved at permissible costs if the isotope is pre-enriched by ionic migration prior to high enrichment in the calutron. A method of isotope separation that is simple in construction and operation is represented by thermal diffusion in a separation tube. Conditions for optimal performance of tube units are discussed.

1574 APTIC NUMBER 17421

Boettger, O.
ISOTOPE SEPARATION BY GAS CENTRIFUGES. (Isotopentrennung mit Hilfe von Gaszentrifugen). Text in German. Kerntechnik, 6(12):571-576, Dec. 1964. 13 refs.

The economy of gas centrifuges are compared to the diffusion method for the production of enriched U235 is discussed. Prior to the economic evaluation, the important technical term 'separating potential' is explained and the physics of gas centrifuges are reviewed. The maximum theoretical separating potential is a function of the circumferential speed and the length of the centrifuge. There are various types of centrifuges such as the evaporation centrifuge, the concurrent centrifuge, and the countercurrent centrifuge. With the evaporation centrifuge, a separating potential of 100% can be reached, but it has the disadvantage that a continuous production process is hardly feasible. With the concurrent centrifuge, between 66 and 80% of the theoretical separating potential can be achieved; with the countercurrent centrifuge, from 90 to 95% can be achieved. For the economic considerations, centrifuges of 1 m length and 400 m/sec circumferential speed were used. The annual maximum costs for such centrifuges were calculated for the actual separating potentials of 33%, 66% and 100%; a price of the 2.5% enriched uranium equal to that on the world market was calculated. At a specific price for enriched uranium of 780 DM/kg and a specific price of natural uranium of 100 DM/kg, the current total costs of such centrifuges may not exceed 250 DM/year in the first case, 460 DM/year in the second case, and 700 DM/year in the third case.

1575 APTIC NUMBER 17530

Boross, L.
SOME PROBLEMS OF THE FLOW OF DUST-GAS MIXTURES. (Beitrag zum Stroemungsproblem von Staub-Gas Gemischen). Text in German. Acta Tech. Acad. Sci. Hung., 66(1-3):21-38, 1969. 10 refs.

From the analysis of the dynamic differential equations for dust-gas movement, two conclusions are drawn. The first is that the conditions are determined from a scalar potential under which the velocity of the dust particles can be derived. Secondly, the conditions are determined under which the potential flow of the gas phase is maintained, despite the effect of the dust content. The similarity extends also to the condition of collision of the grains if the friction and collision coefficients are equal. This is true in the case of exact modeling according to fluid mechanics as well as for the approximate calculation proposed in an earlier paper.

1576 APTIC NUMBER 17489

Brittan, Michael, Harding Bliss, and Charles A. Walker
KINETICS OF THE HOPCALITE-CATALYZED OXIDATION OF CARBON MONOXIDE. Am. Inst. Chem. Engrs. J., 16(2):305-314, March 1970. 74 refs.

The oxidation of carbon monoxide with a hopcalite catalyst was studied in an isothermal recycling reactor; the changes of gas-phase compositions with time were particularly recorded. Gas composition was measured at 35 partial pressures, the ranges of which were considerably larger than those of previous investigations. The reaction rate was strongly dependent on the partial pressure of carbon monoxide, weakly dependent on oxygen partial pressure, and independent of carbon dioxide partial pressure. Conversion-time data, when plotted in first-order form, exhibited important departures from first-order behavior. In early stages, the reaction rate declined more rapidly than in a first-order reaction; in later stages, it declined less rapidly. Reduced gas-phase conditions accelerated the decrease in catalytic activity with time. The decrease was minimized by ensuring that oxidizing gas-phase conditions prevailed. These experimental observations support the hypothesis that adsorption of carbon monoxide is the rate-controlling step in catalytic oxidation with hopcalite. Adsorption is followed by the reaction of the adsorbed carbon monoxide with both oxide and oxygen. A kinetic model proposed for the five most important reaction mechanisms satisfactorily reproduces the experimental data, though it suffers from a considerable scatter among the rate constants.

1577 APTIC NUMBER 17747

Brustad, Tor
THE EFFECTS OF RADICAL SCAVENGERS ON THE RADIOSENSITIVITY OF LYSOZYME IN DILUTE AQUEOUS SOLUTIONS OF VARYING PH. Radiation Res., vol. 27:456-473, Jan.-April 1966. 40 refs.

X-ray inactivation of lysozyme in O2, N2, and N2O saturated solutions was studied within the pH range from 2.5 to about 11. The inactivation-dose curves were exponential when the exposure was carried out in O2 and N2O atmospheres. In an N2 atmosphere, they were usually exponential in alkaline solution, but sigmoid in acid solution. The radiosensitivity decreased when the pH was increased from 2.5-7 in O_2 and in N_2O, and to pH equal 9 in the N_2 atmosphere. At higher pH values, the radiosensitivity increased with increasing pH. Oxygen and N_2O act as radioprotectors relative to N_2 when the pH is between 2.5 and 9; O_2 is more effective than N_2O. At a pH above 10, the radiosensitivity in O_2 is equal to that in N_2O, but greater than in N_2. By changing the pH, the ratio between the radiosensitivity in O_2 and in N_2 is about 1. Lysozyme is inactivated by OH radicals produced both chemically and by photodecomposition of H_2O_2. The sensitivity for inactivation of lysozyme by X-rays in O_2 saturated solution of pH less than 9, changes with pH in the same way as the sensitivity for inactivation by OH radicals. It was also found that the OH scavenger, ethanol, present in the O_2 saturated enzyme solution during irradiation provides a pronounced protection, particularly at low pH values. By considering the reactivities of O_2, N_2O, N_2, and C_2H_5OH toward electrons in aqueous solution, H, and OH in conjunction with the radiosensitivities, approximate estimates of the contributions to the X-ray inactivation of lysozyme in the pH range 2.5-9.0 from each of the radiolysis products were derived. (Author summary modified)

1578 APTIC NUMBER 18073

Calvert, Seymour, Dilip Mehta, and Richard R. Russell
GAS SCRUBBING WITH SUSPENSIONS OF ADSORPTIVE OR CHEMICALLY REACTIVE PARTICLES. Am. Ind. Hyg. Assoc. J., 30(1)57-65, Jan.-Feb. 1969. 8 refs.

Suspensions of adsorptive or chemically reactive particles can give increased and/or sustained efficiency when used for gas scrubbing. Theoretical and experimental work on this type of mass transfer system has led to the development of design methods. Maximum mass transfer rate may be estimated on the basis that liquid concentrations of transferring species for adsorptive particles and reacting species for reactive particles are in equilibrium with the solid phase. The minimum solid concentration required to provide this condition may also be estimated. (Author's Abstract)

1579 APTIC NUMBER 16034

Campbell, K. I., W. L. Crider, H. J. Knott, and M. Malanchuk
ALIEN CONSTITUENTS IN EXPERIMENTAL ATMOSPHERES. Preprint, Aerospace Medical Research Lab. (6570th), Wright-Patterson AFB, Ohio, 15p., 1969. 8 refs. (To be submitted for publication in Proceedings, 5th Annual Conference on Atmospheric Contamination in Confined Spaces.)

The formation of unintentional particulate material during chamber inhalation toxicity studies in which dogs were exposed to nitrogen dioxide with and without ferric oxide dust was investigated. Eight Beagles were exposed to 20-30 ppm NO_2 with and without 0.8-1.0 mg/cu m Fe_2O_3 in the chambers. It was noticed during particulate monitoring that the combined presence of dogs and NO_2 contributed substantially to the aerosol loading in the chamber. The extraneous aerosol response was more than twice that which represented the Fe_2O_3 concentration. In all analyses of samples of significant quantity, nitrate and ammonium ions were relatively abundant while nitrite salts were absent. The observations indicated the presence of particulate matter in excess of certain planned atmospheres, and suggest physical constituents and/or chemicals as a source. Some of this is likely to be respirable. Under certain conditions, a substantial portion of the alien material was nitrogen-bearing, and ammonium nitrate probably assumed a major role. During a study to assess the inhalation toxicity of ozone and employing the same exposure chambers, particulate counts were made with and without dogs and/or ozone. Data suggested that dogs interact with and reduce ozone introduced into the exposure chambers. Ozone appeared to react with chamber atmospheres even in the absence of dogs to produce alien particulate material. Aerosol counts of 18-73% were observed when ozone was introduced to chambers without dogs. Introduction of the same ozone levels increased total particulate counts 11-81% when dogs were in the chambers. Concentrations of ozone and NO_2, when introduced singly and in combination, were determined for the establishment of standard operating conditions to be used in animal exposure studies. While no appreciable chamber loss was observed with ozone and NO_2 introduced singly, in combination ozone was reduced by 63 and 69% at expected concentrations of 1.1 and 3.2 ppm; corresponding NO_2 losses were 13 and 31% at expected concentrations of 9.9 and 18.6 ppm.

1580 APTIC NUMBER 12239

Cohen, Norman and Rolf W. F. Gross
TEMPERATURE DEPENDENCE OF CHEMILUMINESCENT REACTIONS. VOLUME III: THE SULFUR DIOXIDE AFTERGLOW. Aerospace Corp., El Segundo, Calif., Lab. Operations, Contract AF-F04701-68-C-0200, Aerospace Rept. TR-1001(2240-20)-6, Vol. III, AF Rept. SSD-TR-67-157, Vol. III, 9p., Oct. 1968. 5 refs.
DDC: AD 679974

The glow discharge shock tube technique was applied to the sulfur dioxide chemiluminescent afterglow wherein a mild shock is fired into a flowing gas that has passed through an electrical discharge. The shock heats and compresses the gas rapidly, but not to such a high temperature that further dissociation takes place. The SO_2 afterglow continuum was produced by two independent methods: passing SO_2 through a microwave discharge and injecting it into a N_2 stream, or passing O_2 through the discharge and adding OCS downstream. In the second procedure, OCS reacts with O atoms formed in the discharge to produce CO and SO. In both cases, the emission intensity was of second order pressure dependence and varied as T to the minus 1.6 power in the range 300-1500 K. Measurements made in different regions of the spectrum showed no wavelength dependence of the temperature exponent. Absolute emission intensity was determined in the O + OCS system at room temperature by using the O + NO afterglow for calibration. The integrated intensity from 2000 to 5000 A gave a rate constant of 190,000/M/sec, in agreement with previous determinations. (Author abstract modified)

1581 APTIC NUMBER 17561

Delarue, Guy
CHEMICAL PROPERTIES IN THE MOLTEN LICL-KCL EUTECTIC. I. METAL OXIDES. (Proprietes chimiques dans l'eutectique LiCl-KCl fondu. I. Oxydes metalliques). Text in French. Electroanal. Chem., vol. 1:285-300, 1959/1960. 4 refs.

The solubility of a number of metal oxides in the molten LiCl-KCl eutectic are determined qualitatively (with 59 mole % LiCl) at about 500 C and at atmospheric pressure. Using the electrochemical measuring cell and the electrical equipment described in a previous paper, current vs voltage curves were recorded from which was established the oxides which are dissociated in that eutectic. The preparation of the metal oxides in the molten eutectic is briefly described. The results for each of the metal oxides are discussed at length and are summarized. Metal oxides soluble in appreaciable amounts in the molten LiCl-KCl eutectic are CaO, BaO, SrO, CdO, HgO, Ag2O, Sb2O3, Bi2O3, MnO, Cu2O, Tl2O, PbO and CrO3. The metal oxides CoO and Zno are easily soluble, while MgO, Al2O3, SiO2, NiO, SnO, SnO2, Sb2O5, Mn2O3, FeO, Fe3O4, Cr2O3, Ce2O3, PdO, and PtO are little soluble. The current vs voltage curves show that the metal oxides soluble in the eutected are highly dissociated, with the exception of CrO3 which is soluble in molecular form. No case of a redissolution of a metal oxide under foundation of a complex with an excess of O(2-) ions was observed. In the presence of the O(2-) ions, Cu(II), Tl(III) Fe(III), and Au(I) cannot exist in the eutectic. The Ce(4+), Au(3+), and Pt(4+) ions oxidize the Li and K chlorides and, hence, cannot exist in the molten eutectic. The current vs voltage curves show that the same must hold true for the Co(3+), Pb(4+), or Pb(3+) ions. The oxidizing properties of Cu(2+) and of CrO3 have made it possible to order a certain number of redox systems according to their normal potentials relative to the Pt/Pt(2+) reference electrode.

1582 APTIC NUMBER 17507

Eaton, Larry R. and Thomas E. Hoffer
EXPERIMENTS ON DROPLETS IN FREE FALL I: TERMINAL VELOCITY AND WALL EFFECTS. J. Appl. Meteorol., 9(2):269-275, April 1970. 16 refs.

The effect of a surrounding cylinder on the fall velocity of a sphere follows the expression of Fayon and Happel out to Reynolds numbers slightly in excess of 80 (550 micron in diameter), and the ratio of the diameter of the sphere to the diameter of the constraining tube must be at least 1 to 70 for laboratory experimentation to be uninfluenced by a wall at the 1% level. Droplets of ethylene glycol (to eliminate evaporation effects) were produced at a rate of 1000/sec, strongly charged, and deflected into an isothermal column. Flat beams of light traversed the column at 0.30 m intervals and provided a pulse of scattered light when a droplet passed through. Data was transmitted to an on-line computer which averaged the results and greatly reduced errors. (Author summary modified)

1583 APTIC NUMBER 17442

Fluck, E. and H. Binder
REACTIONS OF PHOSPHOR (III) COMPOUNDS WITH SULFUR DIOXIDE. (Reaktionen von Phosphor (III) - Verbindungen mit Schwefeldioxid). Text in German. Z. Anorg. Allgem. Chem., 354(3-4):139-148, 1967. 6 refs.

Sulfur dioxide oxidizes phosphorus (III) compounds according to the reaction: 2P(XYZ) + SO2 gives 2O equals P(XYZ) + S8/8 in which the corresponding phosphoryl compound and elementary S are formed; or according to the reaction: 3P(XYZ) + SO2 gives 2O equals P(XYZ) + S equals P(XYZ), in which the phosphoryl and the thiophosphoryl are formed in the ratio of 2:1. Reactions of SO2 with the following P(III) compounds were conducted: PCl3, PBr3, P(NCS)3, P(NCO)3, P(C6H5)2Cl, P(C6H5)2Cl2, PH3, C6H5PH2, C6H5PH, (C6H5)2PH, P(C6H5)3, P(C6H5)(n-C4H9)2, (C6H5P)5, (CH3O)3P, (C2H5O)3P, P(i-C3H7O)3, (ClC2H4O)3P, (n-C4H9O)3P, (C2H5CH(CH3)O)3P, (n-C5H11O)3P, (C3H7CH(CH3)O)3P, ((C2H5)2CHO)3P, (CH3CH(CH3) CH(CH3)O)3P, (C6H5O)3P, ((CH3)2N)3P and ((CH3)2N)P (C2H5)2. For about 10 g of the P(III) compound, only enough SO2 was condensed at - 78 C so that, according to the first of the above two reactions, but a slight excess of SO2 occurred. In some cases a drop of PBr3 was added as a catalyst. After closing the bomb it was heated to the test temperature and kept there for a given duration. By the use of appropriately dimensioned bombs, it was possible to record nuclear magnetic (31)P resonance spectra without opening the bomb, so that the course of the reactions could be easily followed. After completion of the reaction, the reaction products were analyzed with the aid of the (31)P resonance spectra both qualitatively and quantitatively. These spectra were determined with a Varian - HR - 60 Spectrometer at 24.3 megahz at a field strength of 14090 gauss. A reaction mechanism is proposed. Chemical shifts and coupling constants of many compounds mentioned above as well as of the corresponding oxides and sulfides are listed.

1584 APTIC NUMBER 18075

Fourney, M. E., J. H. Matkin, and A. P. Waggoner
AEROSOL SIZE AND VELOCITY DETERMINATION VIA HOLOGRAPHY. Rev. Sci. Instr., 40(2):205-213, Feb. 1969. 18 refs.

An experimental technique for obtaining the spatial size and velocity distributions for liquid or solid aerosols suspended in an air flow is described. The technique leaves the flow undisturbed and allows for a large range of particle sizes and velocities. The successful combination of a Q-spoiled ruby laser and holography was employed to record the desired information. A helium-neon laser was used to reconstruct the magnified image which was analyzed using closed circuit television. (Author's Abstract)

1585 APTIC NUMBER 12232

Fox, H. L., R. Abilock, R. H. Lyon, and U. Ingard
ON THE FEASIBILITY OF REMOTE ACOUSTIC SENSING OF LOW LEVEL WINDS AND TEMPERATURES. (FINAL REPORT). Bolt, Beranek, and Newman, Inc., Cambridge, Mass., NAPCA Contract PH22-68-3, Job 11355, Rept. 1735, 75p., Nov. 20, 1968. 20 refs.

The using of sound to probe the atmosphere over a city was studied in order to obtain vertical profiles of wind and temperature valid for the city as a whole (horizontal averages), and to detect low-level temperature inversions. Nonuniform winds and temperatures cause sound rays to bend. In particular, sound rays tend to return to the ground during temperature inversions. The considerable horizontal distance traveled by the sound rays also provides horizontal averaging. A basic system, comprising sound source, receiver arrays, and data-processing equipment would permit frequent soundings and interfere little with the city. A review of previous work on acoustic probing of the atmosphere is followed by a presentation of methods for deducing vertical profiles of wind and temperature from acoustic measurements using concepts of 'geometrical acoustics' and the model of a horizontally and temporally homogeneous, vertically stratified nonturbulent atmosphere. The physical limitations of acoustic soundings are discussed. The instrumentation requirements for acoustic soundings as well as economic, logistic, and psycho-acoustic aspects of the contemplated acoustic soundings system are considered. To simulate performance of the acoustic probe, synthetic data were used in conjunction with the above mentioned model of the atmosphere on a digital computer. The computed effective sound velocity profiles are shown in graphs. A proposed distribution of receiver arrays is shown.

1586 APTIC NUMBER 11868

Frysinger, Galen R.
ELECTROCHEMICAL ENERGY STORAGE SYSTEMS FOR VEHICLE PROPULSION. Army Engineer Research and Development Labs., Fort Belvoir, Va., Electrical Power Div., 51p., Nov. 15, 1965.

The development of a new secondary high energy battery with an energy storage density of greater than 0.2KW/lb, recharging time of less than twenty minutes, and an all-over electrical energy efficiency of greater than 70% was initiated with a survey of all the presently produced secondary batteries as well as all the new couples which seemed promising. The review covers the lead acid, nickel-iron, nickel-cadmium, silver-zinc and silver-cadmium systems, the non-aqueous lithium anode secondary systems (either of two systems of electrolytes and/or depolarizer), and the air-zinc, air-cadmium, metal-chlorine, and molten electrolyte liquid ammonia primary system. The conventional systems do not meet the desired requirements. Among the new systems, the molten salt electrolyte couples appear able to meet the requirement if properly designed. They are at a stage where test cells should be made for evaluation. The air-zinc-system is very attractive because of its ambient temperature operation and should be explored, even though it has a lower theoretical energy density. The lithium anode non-aqueous systems presently at the research stage should be evaluated as to capacities ror meeting this requirement because of the tremendous potential for very high energy density.

1587 APTIC NUMBER 11805

Garmany, Jan, Elizabeth Howell, Paul Hutchinson, Robert Land, and Frank Zdybel
THE SIMULATION OF PHOTOCHEMICAL SMOG BY COMPUTER. In: Air Pollution Project: An Educational Experiment in Self-Directed Research, Summer 1968. Associated Students of the California Inst. of Tech., Pasadena, p. 1-31, 1968. 4 refs.

Outstanding work has been done in the development of kinetic mechanisms to explain the variations in pollutant concentrations observed when automobile exhaust is irradiated. In the present investigation, the ability of models to predict concentrations that correspond to experimental observations at any given instant during irradiation was evaluated. These experimental observations represent changes in concentration of the basic constituents of photochemical smog simulating automobile exhaust and irradiated at 3660 A. Five models for simulation of the chamber reaction are presented. Three are classical mechanisms that are incapable of being used as bases for computer simulation. A fourth is a simplified mechanism using novel assumptions devised by Seinfeld for purposes of computer simulation. The last is a mechanism using Seinfeld's assumptions and designed to give an essentially perfect correspondence with empirical data. The success of this model is a strong argument in support of additional research in the area. Differential equations derived from the mechanism are discussed.

1588 APTIC NUMBER 17490

Gasser, R. P. H. and C. J. Marsay
THE CHEMISORPTION OF NITROUS OXIDE AT LOW PRESSURES BY RHENIUM. Surface Sci., vol. 20:116-122, 1970. 10 refs.

The adsorption of nitrous oxide by a rhenium filament was studied at filament temperatures of 298, 1000, and 1220 K and in a pyrex ultra-high vacuum apparatus. An omegatron radiofrequency mass spectrometer was used to measure partial pressures of nitrogen and nitrous oxide. Adsorption proceeded by the abstraction of the oxygen atom from the nitrous oxide molecule; the nitrogen thus generated appeared in the gas phase. At 298 K; the oxygen atom was adsorbed with a sticking probability of 0.45. The maximum uptake at room temperature was 5.7 times 10 to the 14th power atoms sq cm. At 1000 and 1220 K, the initial sticking probability declined to 0.24 and the uptake to 4.5 times 10 to the 14th power atoms sq cm. The continuous decomposition of nitrous oxide set in at filament temperatures above 1600 K. The reaction probably involves the desorption of oxygen atoms from the surface. (Author abstract modified)

1589 APTIC NUMBER 16424

Gaur, H. C. and R. S. Sethi
THERMODYNAMICS OF DILUTE SOLUTIONS OF SILVER HALIDES IN MOLTEN POTASSIUM NITRATE-BARIUM NITRATE. Electrochim. Acta, 13(8):1737-1744, Aug. 1968. 21 refs. (Presented at the Symposium on Electrochemistry, Univ. of Delhi, 1965.)

Potentiometric titrations of dilute solutions of silver nitrate in KNO3-Ba(NO3)2 at 250 C with KCL, KBr, and KI are described. The solubility products of AgCl, AgBr, and AgI were (7.91 plus or minus 0.35) times 0.00001; (4.023 plus or minus 0.23) times 0.000001; and (1.964 plus or minus 0.39) times 10 to the minus 8th power (mole/1000 mg g), respectively. Heats and free energies of solution for the halides were 19.15, 24.05, 32.85 plus or minus 0.5 and 16.96, 20.65, 27.25 plus or minus 2.5 Kcal/mole, respectively. These values were also estimated from available thermal and thermodynamic data by the application of the Flood, Forland, and Grjotheim (FFG) cycle. The agreement between experimental and estimated values was fairly good, indicating the potentiality of such calculations in predicting thermodynamic parameters in reciprocal molten salt systems of the type Ag(+), K(+), Ba(2+)/X(-), and NO3(-). (Author abstract modified)

1590 APTIC NUMBER 17444

Gerhards, Erich and Wilhelm Dirscherl
THE REACTION OF SO3 WITH CYCLOHEXANE; PREPARATION OF POLYENEDIHYDROXYDISULFONIC ACID. (Zur Reaktion von SO3 mit Cyclohexan; Darstellung einer Polyen-dihydroxy-disulfonsaeure). Text in German. Ann. Chem., vol. 642:71-82, 1961. 5 refs.

The ability of Ketosteroids to form sulfur trioxide adducts was studied. Some solvents are not suited for that purpose, since they themselves readily react with SO3 under formation of various sulfurization products. For instance, on introduction of SO3 into petroleum ether, in addition to a brown oil, the sulfurization product of aliphatic hydrocarbons, a blue water-insoluble compound is formed from SO3 and the small amount of benzene present in the petroleum ether. Also, an introduction of SO3 into cyclohexane at room temperature, a brown oil is formed under evolution of SO2 which has a greenish color in aqueous solution. This green reaction product (I) was subjected to spectrophotometric analysis in a methanol and an aqueous solution, both in the visible and the ultraviolet wave-length band and has been tentatively identified as a carbyl sulfate. On hydrolysis of (I), followed by dialysis purification a brown solution (II) was obtained which was subjected to a paper electrophoresis test at 150 V and a pH of 6.9 or 9.0. On the basis of the results of this test, of the mode of its preparation and of its solubilities in various solvents, (II) was classified as a hydrosulfonic acid of the form R-CH(OH)-CH2-SO3H. For closer identification Ba-Ag-and K-salts of (II) were prepared whose chemical composition was determined analytically and compared with several alternative theoretical compositions. The best match was with the formula KC15H18O4S, the molecular formula, most likely being K2C30H36O8S2. Thus, (II) was identified as polyenedihydroxydisulfonic acid having the formula C30H36O8S2 with 13 conjugate double bonds of the form HO3S - CH2 - CH(OH) - (CH equals CH)13 - CH(OH) - CH2 - SO3H.

1591 APTIC NUMBER 15974

Goldman, A., H. D. Lewis, and R. H. Moore
ON THE PROPER USE OF TRANSFORMATIONS OF LOG NORMAL FUNCTIONS IN SMALL PARTICLE STATISTICS. California Univ., Los Alamos Scientific Lab., N. Mex., Contract W-7405-ENG. 36, Report LA-3262, 34p., July 9, 1965. 18 refs.

A standard notation is suggested for use in all fields concerned with small particle data analysis. The representation of particle size data by various forms of the log normal function is discussed and related to methods of particle size measurement. Transformations among parameters defining the functions are discussed, and the general functional relationships are developed and listed in tabular form. The differences among histograms, populations, functional relationships, and probability relationships are emphasized. The use of the proper parameters for data comparison or for distribution definition is also stressed.

1592 APTIC NUMBER 11928

Guillory, William
MATRIX-ISOLATED INFRARED SPECTRUM OF THE FREE RADICAL NO2. Preprint, Howard Univ., Washington, D. C., Dept. of Chemistry, 15p., 1968. 18 refs.

Oxygen atoms produced in the photolysis of nitrogen dioxide underwent limited diffusion through an Ar matrix adjacent to NO2 sites. The resulting reaction appeared to form the symmetrical nitrate radical and possibly the peroxy nitrate radical. The N(15)O2 isotopic substitution experiments and frequency assignments indicate that both species contain only one nitrogen atom. On the basis of the isotopic substitution experiments, the observed frequencies, and the assumed structure of the species, the following possible assignments are made: peroxy radical, 1633, 1265, and 800 reciprocal cm; symmetrical radical, 850, 610 and 550 reciprocal cm. (Author conclusions modified)

1593 APTIC NUMBER 17585

Harmelin, Mireille and Clement Duval
A STUDY OF REACTIONS IN THE SOLID STATE BETWEEN THE TREE OF SATURN AND SALTS CONTAINING THE GROUP XO3: 1. QUALITATIVE STUDY OF THE REACTION BETWEEN LEAD AND THE NO3(-)ION. (Etude de reactions a l'etat solide entre l'arbre de Saturne et des sels contenant le groupement XO3: 1. Etude qualitative de la reaction entre le plomb et l'ion NO3(-)). Text in French. Microchim. Acta, vol. 2-4:211-215, 1964. 5 refs.

In analogy to Hampe's reaction formerly employed in industry to prepare NaNO2 in which Pb flakes were gradually added to molten NaNO3 at about 310 C, nitrites of other metals could be obtained by reaction of Pb with the corresponding nitrates. To investigate this possibility, Pb was prepared in the form of a fine and shiny powder by the technique of growing a 'lead free' from an aqueous 1.5% solution of Pb acetate with the addition of 1% of pure acetic acid. This Pb powder was mixed at room temperature with nitrates of Li, Na, K, Cs, Cu, Ag, Mg, Ca, Sr, Ba, Zn, Tl, Pb, Co, and Ni in the appropriate stoichiometric ratio; the resulting products were analyzed chemically, thermogravimetrically, by differential thermal analysis, infrared absorption spectrography, as well as microscopically. In every case, immediately after the admixture of Pb powder, the presence of the corresponding nitrite could be established with the aid of the alpha-naphthylamine reaction, which is completely insensitive to NO3(-)ions. Among the mixtures submitted to differential thermal analysis, only that prepared with Tl nitrate showed a very strong exothermic peak characteristic of the oxidation of Pb at 170 C. In the others, the oxidation of Pb took place gradually as exemplified by the mixture of Pb with Na nitrate. In the case of K nitrate, the reaction was particularly slow; in the Cu and Ag nitrates, it was extremely rapid and seemed to go beyond the nitrite formation. In all other cases, the reaction was slow and, though the presence of nitrite was chemically ascertained the amount formed was insufficient to show up in the infrared absorption spectra.

1594 APTIC NUMBER 16583

Hassel, O. and Chr. Romming
DIRECT STRUCTURAL EVIDENCE FOR WEAK CHARGE-TRANSFER BONDS IN SOLIDS CONTAINING CHEMICALLY SATURATED MOLECULES. Quart. Rev. (London), vol. 16:1-18, 1962. 54 refs.

The empirical results obtained from structural investigations of solids in which charge-transfer bonds are present linking together electron-donating molecules or parts of molecules and electron acceptors like halogen molecules or halide molecules are summarized. If the acceptor is a halogen (or interhalogen) molecule and the donor possesses a lone-pair atom, a charge-transfer bond between the latter and one of the halogen atoms may be formed, resulting in a linear or at least nearly linear arrangement. There are reasons to believe that the bond to halogen formed by a nitrogen atom of a nitrile group is considerably weaker and that further examples of halogen molecule bridges between nitrite groups may be found. The weakness of the bond between a benzene and a halogen molecule in the 1:1 complex makes it appear natural that halogen molecule bridges between benzene molecules are possible in the solid state with a halogen-halogen distance practically identical with that of the free halogen molecule. If oxygen is replaced by sulfur or amine nitrogen, a significantly shorter donor-acceptor distance results. The distribution of the bonds around the donor atom appears to conform to that observed in halogen addition compounds. So far no exceptions to these simple rules are known, even for crystalline substances with identical molecules containing both halogen and electron-donating atoms. Halogen compounds of ethers, ketones, sulfides, amines, and benzene are discussed.

1595 APTIC NUMBER 11766

Hedley, William H., Richard G. Olt, Lawrence E. Holboke, Aaron H. Kenstam, and Alan L. Wurstner
FLOW THROUGH MICRO-OPENINGS. (SECOND QUARTERLY PROGRESS REPORT OCT. 1-DEC. 30, 1966). Monsanto Research Corp., Dayton, Ohio, Contract DA 18064-AMC-563(A), Proj. 4520, 89p., Jan. 1967. 15 refs.
DDC:AD 811095

The rates of the flow of gases, liquids, suspensions, and solid particles through micro-openings were studied. The purpose was to develop reliable equations to predict flow rates, to produce micro-openings, and to measure flow rates through them. Equations describing the molecular flow of gases through tubes of finite length were derived. Equations describing the flow of gases in the slip regime, suspensions, and solids are available from literature, but their applicability to flow through micro-openings must be determined experimentally. Micro-openings were produced by potting glass microtubing in epoxy resin and cutting samples from the billets formed using a cut-off wheel, although plugging of the bores with particles of epoxy and glass during the cut-off process proved to be a problem. The intentional plugging of the bores with liquid metal prior to cut-off and then removing it appeared to be a solution to the problem. The best methods for measuring the flow rates of gases, liquids, and suspensions through micro-openings at low flow rates were the capillary and differential pressure methods. At higher flow rates, the best methods were liquid displacement and the Hastings-Raydist flowmeter. Suspensions of polystyrene in water appeared to be satisfactory materials for use in suspension flow measurements. A steady flow of a bed of solid particles having diameters less than 20 micron was very difficult to establish because electrostatic charges on the particles caused them to adhere strongly to themselves and to the glass walls of the micro-openings. The flow of gases through 25 and 50 micron diameter micro-openings at pressure drops greater than 10% of the initial pressure followed the compressible Poiseuille equation better than the incompressible Poiseuille equation, but it did not follow either exactly. (Author conclusions modified)

1596 APTIC NUMBER 17383

Hentz, Robert R. and D. B. Peterson
GAS-PHASE PHOTOLYSIS AT 1470 A OF MIXTURES OF CYCLOHEXANE WITH BENZENE AND WITH NITROUS OXIDE AT 750 TORR. J. Phys. Chem., 74(6): 1395-1396, March 19, 1970. 11 refs.

The formation of H2 in the 1470-A gas-phase photolysis of c-C6H12-C6H6 and c-C6H12-N2O mixtures was studied at 750 torr and at 95 deg. The results show no evidence of energy transfer from c-C6H12 to the potential acceptor N2O and demonstrate that H2 formation cannot occur from the same excited state of cyclohexane in both the gas and liquid photolysis at 1470 A. Presumably,

H_2 formation in the gas phase occurs from that state of cyclohexane produced by absorption of a 1470-A photo., and H_2 formation in the liquid phase from a lower, longer-lived state of excitation. It is concluded that both liquid and vapor emissions are molecular origin with the upper state being strongly predissociated in the vapor above approximately 7.7 e V.

1597 APTIC NUMBER 17573

Hoidale, Glenn B. and Abel J. Blanco
INFRARED ABSORPTION SPECTRA OF ATMOSPHERIC DUST OVER AN INTERIOR DESERT BASIN. Pure Appl. Geophys. (Basel), 74(3):151-164, 1969. 11 refs.

A program was initiated in 1966 to investigate the infrared absorption spectra of atmospheric dust samples in the spectral range 4000 to 250 reciprocal cm (2.5 to 40 micron) by microspectrophotometric techniques. For the purposes of the study, 287 samples of atmospheric dust were collected at four sampling sites in a desert basin of south central New Mexico. A representative absorption spectrum is presented and causative minerals are prescribed to the absorption bands. The strongest band is centered at 1027 reciprocal cm (9.7 micron) within the 1250 to 770 reciprocal cm (8 to 13 micron) atmospheric window, and is silicate induced. Two other strong broad absorption bands are the carbonate band at 1425 reciprocal cm (7.0 micron) and the silicate band at 469 reciprocal cm (21.4 micron). Temporal variations in the absorption spectra of the dust are observed primarily in the varying intensities of the 1027 and 1425 reciprocal absorption bands and in the occasional enhancement of the 1027 band caused by sulfates in the dust. A close similarity exists between the absorption spectra of atmospheric dust and the spectra of the small particle fraction of area soils, and between the representative dust spectrum and a spectrum of a synthetic mixture (by weight) of 80% silicates, 16% carbonates, and 4% nitrates. (Author abstract modified)

1598 APTIC NUMBER 12255

Horst, T. W.
A REVIEW OF PARTICLE TRANSPORT IN A CONDENSING STEAM ENVIRONMENT. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab., AEC Research and Development Rept., 45p., June 24, 1968. 69 refs.
CFSTI: BNWL-848

Basic information is reviewed regarding those phenomena which are unique to a condensing steam environment or are altered by the presence of condensing steam, with the view of predicting particle transport. These phenomena include condensation in the presence of an inert gas, diffusiophoresis, thermophoresis, particle nucleation and growth, and Brownian and turbulent diffusion. Thermophoresis appears to be negligible compared to diffusiophoresis, including the effect of the bulk flow of water vapor towards a condensing surface. In laminar flow, the dominant mechanism for deposition to containment walls will thus be diffusiophoresis. Gravitational settling will also be important for horizontal surfaces. In turbulent flow, the inertial deposition of the particles may completely overshadow all other effects except possibly the movement of the particles with the bulk flow of water vapor. All of these forces depend on particle size to some extent. Thus, particle growth due to condensation must be taken into account. Nucleation and condensation will occur most readily on soluble particles and on insoluble particles with a small contact or wetting angle. Due to the fact that the quantities governing the forces on the particles are all closely interrelated, it may be possible to correlate particle deposition with a single parameter of the condensing steam system.

1599 APTIC NUMBER 17743

Ishikawa, Fusao, Saburo Mitsui, and Toyosaku Murooka
EQUILIBRIUM OF A CHEMICAL SYSTEM OF CAMPHOR AND SULFUR DIOXIDE. (Shono-Nisanka-yuo-kei no heiko ni tsuite). Text in Japanese. Rikagaku Kenkyusho Iho (Bull. Inst. Phys. Chem. Res. (Tokyo), 13(7):684-696, July 1934. 2 refs.

Thermal change of a chemical equilibrium between camphor and sulfur dioxide was discussed on the basis of Bulluci and Grassi's presentation (Chim. Ital. 44(5):559,1914). A purified crystal camphor with the melting point of 178.24 C and SO_2 purified by concentrated sulfuric acid were used. A certain amount of liquid SO_2 was added to two grams of camphor at regular intervals for several hours (more than ten hours). The amount of SO_2 absorbed by the camphor (2 grams) and the pressure of equilibrium (mm.Hg) were measured under several temperatures (30, 20, 10, 0, -16, -31, and -38 C), and the relationships among these factors were obtained. The affinity of SO_2 to camphor and the reaction heat was thermodynamically measured.

1600 APTIC NUMBER 11672

Jellinek, H. H. G. and F. Flajsman
REACTION OF NITROGENDIOXIDE WITH POLYSTYRENE FILMS. Preprint, Clarkson Coll. of Tech., Potsdam, N. Y., Dept. of Chemistry, 29p., 1968 (?). 5 refs.

The reaction of nitrogen dioxide with thin polystyrene films was investigated at 35 C with different partial pressures of NO_2 (0.1, 2, 15, 30 and 60 cm Hg) and at several temperatures (25, 35, 45 and 55 C). The films were thin enough (ca. 20 micron) so that the reaction was independent of the diffusion of gas into the polymer. The experimental results can be represented by a chain mechanism. The whole degradation process is controlled by the diffusion of polymer radicals out of cages. This diffusion, in turn, is affected by the decrease in viscosity or decrease in weight average molecular weight as degradation proceeds, leading to an acceleration of the degradation process. A straight line relationship between the logarithm of the reciprocal weight average molecular weight and the logarithm of a reaction-time function was found. The dependence on the rate was substantiated by degrading polymer fractions. The energy of activation for the process is small, in agreement with a diffusion process for chain scission. Nitro and nitrite groups are incorporated along the backbone of polystyrene during exposure. The number of these polar side groups appears to pass through a maximum with time, as is evidenced by aggregation of polymer molecules in benzene solution only during the middle stage of the degradation. The final stage of the process is slowed down by retarder being produced. This retarder can be removed by reprecipitation of exposed polymer films. Degradation in solution is similar to that of films. Isotactic polystyrene shows less irregularities in its degradation curve than the atactic polymer. This is, presumably, due to its more homogeneous morphology, large molecular weight, and broader molecular size distribution. The plot of the degree of degradation versus time for the isotactic polymer can be satisfactorily approximated by a straight line. (Author summary modified)

1601 APTIC NUMBER 17547

Katz, Morris
PHOTOCHEMICAL REACTIONS OF ATMOSPHERIC POLLUTANTS. Can. J. Chem. Eng., vol. 48:3-11, Feb. 1970. 44 refs. (Presented at the 19th Chemical Engineering Conference, Edmonton, Alberta, Oct. 19-22, 1969.)

The present status of research on the photochemical reactions of atmospheric pollutants is reviewed. Although it is difficult to relate controlled laboratory experiments directly to field conditions, considerable knowledge had been obtained as to the kinetics, mechanisms, and nature of the reaction products involved in photochemical processes. Significant absorbers of solar energy in wavelengths above 300 A that penetrate the lower atmosphere include nitrogen dioxide, nitrous and nitric acid, sulfur dioxide, hydrocarbons, and other reactive substances and particulates. In the photochemical process, organic and other free radicals are formed by primary and secondary photodissociation processes. These free radicals can undergo reactions leading to the formation of short or long chains containing a number of sequence steps until the chain is terminated by chain-breaking mechanisms. Field and laboratory data are cited to show the influence of humidity, nitrogen dioxide, light intensity, and olefins on the rate of SO2 photooxidation. (Author summary modified)

1602 APTIC NUMBER 17440

Kern, Rudolf
METHOD FOR PRODUCING WATER SOLUBLE OR WATER EMULSIFYABLE SULFURIC ACID ESTERS OR SULFURIZED SULFURIC ACID ESTERS OF ALIPHATIC OXY COMPOUNDS WITH MORE THAN NINE CARBON ATOMS. (Verfahren zur Herstellung von wasserloeslichen bzw. von mit Wasser emulgierbaren Schwefelsaeureestern oder geschwefelten Schwefelsaeureestern aliphatischer Oxyverbindungen mit mehr als 9 Kohlenstoffatomen). Text in German. (Chemische Fabrik R. Baumheier A. G., Oschatz, (E. Germany)) W. German Pat. 648,443. 5p., April 12, 1933. (2 claims).

High molecular sulfuric acid esters or sulfurized aliphatic sulfuric acid esters can be obtained rather easily by the reaction of aliphatic oxy-compounds having more than 9 carbon atoms with sulfur dioxide under pressure and in the presence of pyridine. Paraffin alcohols and natural or synthetic fat alcohols can be used for the reaction. The oxy-compounds may be single or multi valent, saturated or unsaturated. They may be used alone or in solution with acetone, benzene, chlorine containing hydrocarbons, or low-molecular alcohols. Addition of pyridine speeds up the reaction. It is advantageous to let the reaction take place in the presence of sulfites such as sodium sulfite, potassium sulfite, or mixtures of these substances. Addition of copper, bronze or copper salts, or even iodine has a favorable influence. It is important to exclude any water from the reaction. Eight practical examples are given.

1603 APTIC NUMBER 11822

Klug, W.
THE GOVERNING EQUATIONS OF TURBULENT MOTION IN A HORIZONTALLY HOMOGENEOUS SURFACE LAYER. In : Notes on the Theoretical Basis of the Equations for the Atmosphere's Surface Layer. Environmental Science Services Administration, Oak Ridge, Tenn., Inst. for Environmental Research, TM-IERTM-ATDL-7, p. 12-16, Nov. 1967.

Starting with the equations of motion, continuity, and rates of change of energy as given by the Boussinesq approximation, equations governing the surface layer were derived. During the derivation, it was assumed that the surface layer is horizontally homogeneous. Each of the three variables of state, density, pressure, and temperature were divided into three terms: a term which gave the average of the quantity over the whole domain; a term which considered the height variation of the quantity during the absence of motion; and a term which took into account the turbulent fluctuations of the quantity concerned. Model assumptions for the atmospheric surface layer were as follows: stationarity of all quantities; horizontal mean flow; the coordinate system directed with its x axis in the direction of the mean flow; and horizontal homogeneity of the mean temperature field. Horizontal homogeneity of the turbulent fluxes and of the mean flow was also assumed.

1604 APTIC NUMBER 11820

Kofoed-Hansen, O. and C. F. Wandel
ON THE RELATION BETWEEN EULERIAN AND LAGRANGIAN AVERAGES IN THE STATISTICAL THEORY OF TURBULENCE. Danish Atomic Energy Commission, Risoe, Research Establishment, Risoe Rept. 50, 52p., June 1967. 11 refs.

Two important types of probing of a turbulent velocity field are the Eulerian probings and the Lagrangian probing. In the case of fully developed isotropic and homogeneous turbulence, explicit expressions in terms of the energy spectrum are derived for the autocorrelation coefficients and power spectra obtained by Eulerian and Lagrangian probing. The derivations, which are given in detail, are based on a statistical representation of the turbulent velocity field using the results of the equilibrium theory of turbulence. The Tailor hypothesis is verified in the limit of high probing velocities. The Hay-Pasquill conjecture relating the Lagrangian and Eulerian power spectra is obtained as an approximation to the transformation equations. Application of the results to the theory of turbulent diffusion is indicated. (Author abstract)

1605 APTIC NUMBER 17523

Konishi, Ichiro, Toshie Okumura, and Hiroshi Ohba
WELDABILITY TESTS THICK, ATMOSPHERIC CORROSION RESISTANT, HIGH-STRENGTH STEEL PLATES. (Atsuita taikosei kochoryokuko no yosetsusei shiken). Text in Japanese. Doboku Gakkaishi (J. Japan Soc. Civil Engrs.), 55(2):79-87, Feb. 10, 1970.

The establishment of Japanese industrial standards for atmospheric corrosion resistant hot-rolled steel for welded structures in April, 1968 opened a new era to steel bridges. Since the chemical compositions of these steels vary over wider ranges than common steels, the selection of an appropriate steel for a specific purpose and the supervision of welding are important. Experiments were designed to fix the weldability limits of these steels. Welding breaks can occur in the manufacturing or processing of high-strength steel; for bridges, pressure containers, oceanographic equipment, etc. Therefore, the relation between the chemical content and welding property of any high-strength steel plate should be sufficiently scrutinized. The amount of Cu, Cr, or other alloys should be as low as possible. In tack or fillet welding, care must be taken not to initiate cracking. The hygroscopic property of the welding rod should be understood. In butt welding, a submerged arc should be employed whenever possible. When working conditions are difficult, the low-hydrogen system welding rod prevents the occurrence of cracks in narrow plates. For thick plates, electro-slag welding is applied. In gas cutting, attention must be paid to the roughness of the cut surface.

1606 APTIC NUMBER 17792

Koontz, R. L., R. S. Hubner, and N. A. Greenfield
THE EFFECT OF AEROSOL AGGLOMERATION ON THE REDUCTION OF THE RADIOLOGICAL SOURCE TERM FOR THE LMFBR DESIGN BASIS ACCIDENT. North American Rockwell Corp., Canoga Park, Calif., Atomics International Div., AEC Contract AT(04-3)-701, 93p., Sept. 15, 1969. 19 refs.
CFSTI: AI-AEC-12837

Calculations of the stirred settling rate of particles with heterogeneous distributions characterized as log normal are presented. The leaked fraction of the radioactive materials released during a LMFBR-DBA (Liquid metal fast Breeder Reactor-Design Basis Accident) may be considerably reduced due to agglomeration and settling of the aerosols. A computational procedure is given for studying the reduction factor of the radiological source term as a function of the aerosol in a small test chamber, which relates mass concentration, in partially sealed containers, to the aerosol particle size distribution which agglomeration produces. When the particle size distribution, the leak rate, and the height of the enclosure are specified, the leaked fraction at any time can be read from the figures presented in the report. If a functional dependence which is different from that recommended is used between the concentration and size, the computed relations of leak and size are still applicable. The particulates of each material are assumed to agglomerate into aggregates containing a mixture of all of the airborne species, and thus the leaked fraction of the total mass is indicative of that of any other species. The model developed is recommended as a tentative solution to a very complicated problem, and is thought to be both conservative, physically realistic, and usable for practical evaluations of LMFBR radiological safety until a more rigorous treatment can be developed. (Author summary modified)

1607 APTIC NUMBER 12151

Kopa, Richard D., Blanche R. Hollander, Frederick H. Hollander, and Hiroshi Kimura
COMBUSTION TEMPERATURE, PRESSURE AND PRODUCTS AT CHEMICAL EQUILIBRIUM. California Univ., Los Angeles, Dept. of Engineering, R-64-1, 104p., April 1964. 37 refs.

The computation of the theoretical reaction products at chemical equilibrium which result from the combustion process of hydrocarbon fuel in air was presented. A system of 18 nonlinear algebraic equations was developed for the computation of 18 reaction products. Results of the computation of the combustion at specified equilibrium temperatures and pressures were presented. For the computation of the equilibrium combustion temperature and pressure, the original set of 18 equations was enlarged by energy and mass balance equations and the procedure was applied to constant volume and constant combustion. Cases of combustion, including the effects of air-fuel ratio as well as the effect of water addition or exhaust gas addition to combustible mixtures, were computed and the results presented in charts. The charts were applied to the determination of the peak combustion temperature in an internal combustion engine. The procedure of transformation and coding of the equation system for solution on electronic computer was described. Part of the program was written in SWAC and part in FORTRAN. Tabulated values of enthalpy and equilibrium constants employed in the calculation, as well as literature references for other thermodynamic constants, were included. Samples of the computational results were presented. (Author abstract modified)

1608 APTIC NUMBER 17435

Kuz'minykh, I. N. and M. D. Babushkina
EQUILIBRIUM BETWEEN SULFUR DIOXIDE AND CALCIUM BISULFITE SOLUTIONS. (Ravnovesiye mezhdu sernistym gazom i rastvorami busul'fita kal'tsiya). Text in Russian. Zh. Prikl. Khim., vol. 29:1488-1493, July-Dec. 1956. 9 refs.

Sulfur dioxide vapor pressure over a saturated calcium bisulfite solution was measured at temperatures of 4.5 to 60 C. Measurements differed from previously reported values and it is thought that this was due to the fact that the test solutions are not saturated with respect to the bisulfite at temperatures above 37 C, where equilibrium shifts in the direction of calcium hemisulfate.

1609 APTIC NUMBER 17548

Lasiewicz, Krystyna, Aleksandra Pudliszak-Dziewanowska and Juliusz Wesolowski
POROUS STRUCTURE OF VANADIUM CATALYSTS FOR SO_2 OXIDATION.
(Struktura porowata katalizatorow wanadowych do utleniania SO_2). Text in Polish. Przemysl Chem., 48(3):140-143, March 1969. 2 refs.

The dependence of the activity of vanadium catalysts used in sulfur dioxide oxidation on the porous structure was studied. The oxidation of SO_2 was carried out at 400-520 deg and at an SO_2 concentration of about 7% in the mixture with air. The radius of catalysts of domestic (i.e. Polish) and foreign production varied between 75-75000 A; their specific volume was 0.12-0.65 cc/g and specific surface, 2.4-6.3 sq m/g. The catalyst with the pore radius greater than or equal to 5000 A gave the fastest oxidation rate with a high degree of conversion. Relatively high activity was found for catalysts where about 90% of the pores had a radius greater than 1000 A. Thus the disturbance of internal diffusion caused by small dimensions of pores exerts a determining effect on the velocity of the catalytic process. The catalysts with good activity possess a similar fraction of big pores. The catalyst containing the largest fraction of pores with radius smaller than 1000 A and having the largest surface was the least active.

1610 APTIC NUMBER 12395

Marmo, F. F.
VUV ELECTRON SPECTROSCOPY OF ATMOSPHERIC GASES. In: Experimental and Theoretical Studies in Planetary Aeronomy. (Quarterly Progress Report). GCA Corp., Bedford, Mass., Contract NASW-1726, p. 17-18, Jan. 1969
CFSTI: N69-15525

The photoelectron spectra of nitric oxide, carbon monoxide, and carbon dioxide were obtained at wavelengths of 469.8 A and 416.2 A. For CO and CO_2, no new ionization potentials were observed, at least up to the limiting photon energy. However, for the case of NO, a new higher ionization potential was observed at 21.57 eV, although no new evidence was found for the alpha-series at 14.32 eV. The ionizing radiation was an Ar IV line of wavelength 462 A, produced by a low pressure condensed spark discharge in a capillary and dispersed by a monochromator. The band pass of the monochromator was 1A. Considerable unresolved vibrational structure occurred between 15.7 and 19.5 eV for NO. It was suggested that the transition probability for ionizing a state at the alpha-series could be exceedingly small at 548 A and not observed.

1611 APTIC NUMBER 17441

Mastryukov, B. S., I. A. Pribytkov, and V. A. Krivandin
ON OPTICAL PROPERTIES OF FINELY DISPERSED SOOT PARTICLES.
(K voprosu ob opticheskikh svoystvakh melkodispersnykh sazhistykh chastits). Text in Russian. Izv. Vysshikh Ucheba. Zavedenii Chernaya Met., 10(9):166-170, 1967. 9 refs.

A sooty gas stream with practically the same concentration, mean dispersion of the particles, and temperature of the gas phase, but with a higher H_2 - content of the particles, has a higher total attenuation coefficient. By considering the thermal equilibrium of particles suspended in the gas stream and reacting with it, the temperature of the H_2 - bearing soot particles was computed and was very nearly equal to the temperature of the gas phase, thus rendering Russel's hypothesis regarding the above phenomenon questionable. The spectral brightness of the emission and the spectral attenuation coefficient along the stream of soot particles was measured with the aid of a photoelectric pyrometer. These varied with the H_2 content of the particles, other things being equal in the same manner as their integral counterparts. Proceeding from the law of Buger - Ber according to which the spectral attenuation coefficient of the soot can be represented in the form: a equals 1 - exp(-1.5 C), where C is a function of several geometrical parameters and of the optical extinction coefficient, K. This coefficient is a function of the complex index of (optical) refraction; the latter is dependent on the 'degree of graphitization' and hence, on the H-content of the polycyclic condensed aromatic hydrocarbons forming the soot particles. The hypothesis that first mentioned phenomenon is due to a difference in the optical properties of the soot particles having different elementary compositions satisfactorily explains the experimental data but is in need of direct verification.

1612 APTIC NUMBER 17541

Mori, Yoshiro
INFLUENCE OF AIR HUMIDITY ON AIRBORNE DUST GENERATION PHENOMENA.
(Bifuntai hatsujin gensho ni taisuru kukishitsudo no eikyo). Text in Japanese. Kagaku Kogaku (Chem. Eng.), 34(2):198-203, Feb 5, 1970. 3 refs.

The influence of relative humidity on the generation of airborne dust was determined in laboratory tests to be considerable and to affect not only the generation rate but the conglomerating condition of dust. The literature contains extensive data on fluidized beds of rather large particles, but little on airborne dust. Airborne dust was generated in a fluidized bed (Al_2O_3), spounted bed (SiO_2), and rotation mixer (SiO_2). A 140-mm diameter and 1,500-mm high plastic cylindrical fluidized bed was used. The experiments were performed at 25 C and at 40% to 70% relatively humidity. The demonstrated influence of humidity on dust generation is not in accord with the theory that relates the rate of airborne dust generation to the particle density in a fluidized bed. However, the velocity increase is approximately proportionate to the square root of the particle density, and reaches a maximum at a certain point. This increase is more distinct at higher humidity and lower air velocity. The differences between the present findings and previous research may be due to the minute particles employed. In the experiments with a fluidized bed of airborne dust, the effects of adhesion among particles and condensation forces cannot be neglected. Humidity affects the fluidizing rate and bubble size. One of the causes of the adhesion of dust particles and condensation forces is the absorbed moisture on the surface of particles. Under the condition of extremely low humidity, electrostatic charging to the equipment and adhesion of particles to the cylinder surface was observed. In this region, the generation rate tends to reach a maximum, presumably due to the effects of adhesion and condensation of particles by electrostatic force. The rate of condensation of the airborne dust generated at higher humidity and lower generation velocity was high. Additional research in this field appears to be indicated.

1613 APTIC NUMBER 17420

Navratil, Josef and Jaroslav Nyvlt
KINETICS OF THE ABSORPTION OF GASES INTO FLUIDS, TOGETHER WITH CHEMICAL REACTION. PART III. (Kinetika absorpce plynu do roztoku kombinovane s chemickou reakci - III). Text in Czech. Chem. Prumysl (Prague), 17(6):291-297, June 1967. 17 refs.

The speed of absorption was measured in relation to time in the system sulfite-ammonia-hydrogen. The relationship was correlated by means of relations derived for the speed of absorption with respect to the first order chemical reaction. The speed constant of the chemical reaction hydrogen versus ammonium sulfite was separated in solution using this relationship. The study of the basic problem of removing sulfur dioxide from stack gases by means of absorption into the solution of ammonium sulfite is the reaction of hydrogen with the sulfite. There are physical - chemical constants in all equations for the speed of absorption that takes place simultaneously with the chemical reaction. Their evaluation is very difficult with classical methods. To overcome this, two equations are given and experimentally verified. It was proved that in the measured interval, the speed of absorption does not depend on the hydrodynamic conditions.

1614 APTIC NUMBER 17432

Neumann, Bernhard
CATALYSIS OF SULFURIC ACID. V. (Zur Schwefelsaeuekatalyse. V.) Text in German. Z. Elektrochem., 38(5):304-311, 1932. 31 refs.

Previous studies of the effects of metal oxides on the process of oxidation of sulfur dioxide to sulfur trioxide showed that oxidic substances have a good catalytic effect when several valence levels exist, so that fast reduction of oxidation is made possible by the change of valence between these levels. The effects of CuO, MnO_2, PbO_2, MoO_3, CeO_2, Bi_2O_3, UO_3, and two $CuO + Cr_2O_3$ mixtures were studied. Pure CuO moistened with water, was shaped into tablets and inserted into the contact tube, sulfur trioxide mist began to form at a test temperature above 400 C. The degrees of conversion of SO_2 using CuO of different test temperatures are given as are those previously obtained using TiO_2. Both sets of data suggest that the dissociation pressure of intermediately formed sulfates assumed on the basis of previous findings, to be essential for a strong catalytic effect cannot be the decisive factor, but it is rather the greater or smaller ease with which oxygen can be taken up or given off by the oxidic catalyst that plays the important role. In this context the previously observed strong catalytic effect of Cr_2O_3 suggests that it is not Cr_2O_3 itself but rather a higher Cr oxide which exerts the catalytic action in a valence change with Cr_2O_3. The catalytic effects of MnO_2, Mn_2O_3, PbO_2, Bi_2O_3, UO_3, and CeO_2 expressed as degree of conversion of SO_2 at different test temperatures is shown. The data for MoO_3, show that the oxidation of $N-SO_2$ begins at a temperature at which MoO_3 begins to sublimate, being similar in this respect, but inferior as a catalyst to the previously studied WO_3. The degree of conversion of SO_2 using $CuO + Cr_2O_3$ mixtures with 33.3 and 50 mole% Cr_2O_3 is shown, together with those for pure CuO and Cr_2O_3.

1615 APTIC NUMBER 11697

Newhall, Henry K.
KINETICS OF ENGINE GENERATED NITROGEN OXIDES AND CARBON MONOXIDE. Preprint, 34p. 46 refs. (Presented at the Symposium (International) on Combustion, 12th, Poitiers, France, July 14th, 1968.)

A qualitative theoretical analysis of chemical kinetics of the internal combustion engine expansion process was undertaken with special reference to the behavior of nitric oxide and carbon monoxide during expansion. The problem was cast as an initial value problem. Rate expressions for 32 elementary chemical reactions were combined to yield 13 coupled, nonlinear differential equations representing 13 chemical species. These equations were numerically integrated together with the coupled energy equations, starting at the initial point of the expansion process. Results were obtained in the form of concentration-time histories for each of the species considered throughout expansion. It was found that the atomic species and the hydroxyl radical fail to recombine at a rate sufficient to maintain a continuous chemical equilibrium. Consequently these species persist in excess quantities throughout the process. It was further found that the persistence of excess concentrations of these species severely inhibits the oxidation of carbon monoxide during expansion. Of the five elementary reactions directly involving nitric oxide, none was sufficiently rapid to effect an appreciable decomposition.

1616 APTIC NUMBER 17558

Ormrod, Douglas P. and C. Joy Woolley
APPARATUS FOR ENVIRONMENTAL PHYSIOLOGY STUDIES. Can. J. Plant Sci. (Ottawa), vol. 46:573-575, Sept. 1966.

The modification and use of a commercially available controlled-temperature and -humidity chamber for measuring the effects of several environmental factors on plant processes is described. The chamber was useful in experiments measuring effects of light, temperature, and humidity on carbon dioxide exchange rates of barley and pea plants. Temperature is controlled automatically from 0 to 75 C and relative humidity from about 30-98%. Accuracy of performance is plus or minus 0.5 C for dry bulb temperature and plus or minus 0.4 C for wet bulb temperature. The rate of air circulation in the chamber can be controlled. The unit may also be used for plant pathology studies and experiments with small laboratory animals and insects.

1617 APTIC NUMBER 17437

Padberg, Karl-Heinz
DETERMINING THE PERMEABILITY FOR AIR OF TEXTILES. (REMARKS TO DIN 53 887). (Bestimmung der Luftdurchlaessigkeit von textilen Flaechengebilden (Bemerkungen zu DIN 53 887)). Text in German. Melliand Textilber., 47(12):1377-1380, 1966. 9 refs.

Any method to determine the air permeability of textiles must take into account that the majority of materials are not homogeneous. If a maximum confidence interval of plus or minus 5% to plus or minus 10% and a statistical certainty of 95% is required, a measurement with five individual values (as recommended by DIN 53 887) is not sufficient. A two-way variance analysis must be performed to determine the dispersions. Only when the homogeneity of the material is confirmed is it advisable to combine measured values for evaluation. The measuring units as well as the personnel can be checked by preparing test fibers. Evaluation of the results is carried out by means of a t-test.

1618 APTIC NUMBER 17582

Paul, Ram Chand, Suraj Parkasn Narula, and Prabha Mayer
CONDUCTOMETRIC STUDIES OF MIXTURES OF SULPHUR TRIOXIDE WITH ORGANIC ESTERS. Bull. Nat. Inst. Sci. India, no. 29:209-213, 1965. 8 refs.

Conductivity graphs were obtained for mixtures of sulfur trioxide and following esters: ethyl formate, methyl acetate, ethyl acetate, ethyl propionate, ethyl butyrate, ethyl isovalerate, and isobutyl acetate. Only the curves for the conductivity between sulfur trioxide and methyl acetate or ethyl acetate indicate the formation of compounds at sulfur trioxide/ester molar ratios of 1:2 and 1:1. The possible formation of a sulfur trioxide-ethyl formate compound at 1:2 is suggested. The conductivity composition curves for ethyl propionate, ethyl butyrate, ethyl isovalerate, and isobutyl acetate indicate the formation of only one compound with a 1:1 molar ratio. From the results, it is evident that only the esters with low molecular weights form two compounds on addition of sulfur trioxide.

1619 APTIC NUMBER 17428

Poginskiy, S. Z. and Yu. N. Rufov
CHEMOSORPTION OF MIXTURES ONTO NIO. (Izucheniye khemoscorbtsii smesey na NiO). Text in Russian. Kinetika i Kataliz, 7(1):136-143, 1966. 10 refs.

The chemosorption of mixtures, comprised of various combinations of donors and acceptors, onto nickel oxide was studied. The effect of preadsorption of one gas on the adsorption of another was examined. As a rule, surface coverage during absorption of a mixture is less than the additively adsorbed quantity, but three cases of superaddivity were observed. The total accumulated data are better explained by the presence of adsorption competition between components on the surface than by the electron theory of chemosorption onto semiconductors in its generally accepted simplified form. Absorption data are given for various combinations of the following: carbon monoxide, oxygen, nitric oxide, pyridine, acetone, and sulfur dioxide.

1620 APTIC NUMBER 11849

Powell, Robert Stephen
ANALYSIS OF POLYDISPERSE PARTICLE ENSEMBLES BY LIGHT SCATTERING TECHNIQUES. Catholic Univ. of America, Washington, D. C., Thesis (Ph.D), Ann Arbor, Mich., Univ. Microfilms, Inc., 1966, 75p. 16 refs.

Observations of the light scattered by polydisperse particles with dimensions comparable to the wavelength of the illumination were used to deduce the size distribution and composition in the ensemble. A mathematical method was presented whereby the size distribution and refractive index of polydisperse particles were deduced from light scattering measurements. The general optical properties of polydisperse particle ensembles were described. Graphs were presented which may be used to replace the voluminous tabulations from the Mie theory when the particles are polydispersed. The polarization and angular distribution of light scattered by suspensions containing zinc oxide fourlings or magnesium oxide cubes was compared to that expected from spherical particles. The randomly aligned, irregular particles scatter almost like spheres in the angular range of 60-150 degrees. Scattering measurements in this range cannot be used to deduce the shapes of randomly aligned particles. However, the size distribution and refractive index of an ensemble containing randomly aligned particles of any shape can be deduced by fitting the measured scattering to calculations from the Mie theory. Measurements of the scattered continuum from comet Arend-Roland were analyzed using some of the results previously calculated to determine the refractive index and size distribution of the particles. The measured data were insufficient to allow for unique determination, but dielectric particles with a refractive index between 1.2-1.8 are possible. The number of iron particles in the comet was probably small, if they exist at all. (Author abstract modified)

1621 APTIC NUMBER 17781

Preston, G. T., T. W. Chapman, and J. M. Prausnitz
TRANSPORT PROPERTIES OF CRYOGENIC LIQUIDS AND THEIR MIXTURES.
Cryogenics, vol. 7:274-279, Oct. 1967. 65 refs.

Transport properties of liquefied gas are required for rational design of cryogenic processes. However, in the absence of sufficient experimental data, the design engineer commonly resorts to crude extrapolations and unreliable estimates. This work presents generalized correlations for predicting viscosity, thermal conductivity, and diffusivity of the saturated liquids argon, xenon, neon, krypton, methane, oxygen, nitrogen, carbon monoxide, and ethylene. The molecular parameters appropriate for the simultaneous correlation of all three properties were empirically determined by bringing together all experimental information on the properties within the theoretical framework of the corresponding-states principle. A method is also proposed for applying the correlations to predictions of mixtures.

1622 APTIC NUMBER 17528

Prodi, Franco, Vittorio Prodi, and Gaetano Fiore
DISTRIBUTION OF CONTAMINANTS IN ICE GROWN BY ACCRETION. J. Appl. Meteorol., 9(2):283-288, April 1970. 11 refs.

Microchemical analysis and x-ray micrographs were performed on thin slices of ice cylinders artificially grown in a tunnel by accretion of supercooled droplets of contaminated water, and characteristic distribution patterns of contaminants were determined for various types of growth, with reference to contaminant transport that can take place in bulk ice. Transport of insoluble particles by the advancing ice-water interface during final freezing of the spongy structure was observed, although preformed ice structures are generally effective obstacles. Soluble impurities behave similarly when associated with insoluble inclusions, but if alone, they migrate with a much higher velocity; following penetrating radial crystals, they can cross those structures that are obstacles for solid particles. New insight on the formation of dry growth lobes and of large radial bubbles was gained by superimposing wet growth upon dry accretion. As the conditions of the experimental growth are representative of many natural environments, the results obtained can be extended to analysis of hailstone slices and used to infer actual environments. (Author conclusions modified)

1623 APTIC NUMBER 17536

Rao, T. Navaneeth and Jack G. Calvert
THE WAVELENGTH DEPENDENCE OF THE PRIMARY PROCESSES IN THE PHOTOLYSIS OF SULFUR DIOXIDE. J. Phys. Chem., 74(3):681-685, Feb. 5, 1970. 12 refs.

The fluorescence and phosphorescence quantum yields of sulfur dioxide, as measured on an absolute spectrophosphorimeter, were calculated for the wavelengths 2650, 2750, 2963, and 3020. The ratio of the quantum yield to that of fluorescence at each wavelength checked well with those reported by Mettee. However, Stern-Volmer plots of the fluorescence data obtained in the present investigation provided new estimates of the rate constant ratios as a function of wavelength. At 2650 and 2750 Å, the agreement between the data of the authors and that of Mettee was only within a factor of about 2. The findings suggest that Mettee's conclusion of perfection efficiency of fluorescence of SO2 at zero pressure cannot be accepted without reservation. Apparently, internal energy dissipation in sulfur dioxide can compete favorably with fluorescence emissions even in the limit of zero pressure.

1624 APTIC NUMBER 17491

Rayner, H. B. and F. E. Murray
THE PHOTOLYTIC OXIDATION OF METHYL MERCAPTAN, DIMETHYL SULPHIDE AND DIMETHYL DISULPHIDE. Pulp Paper Mag. Can. (Quebec), 71(7):75-77, April 3, 1970. 9 refs. (Presented at the Fifth Paper Industry Conference on Air and Stream Improvement, Toronto, Canada, Oct. 21-23, 1969.)

A study was made of the effects of ultraviolet radiation at long and short wavelengths (3600 A and 2357 A) on the rates of oxidation of methyl mercaptan, dimethyl sulfide, and dimethyl disulfide in air. Attempts were made to identify the reaction products by mass spectrometry. Oxidation rates were substantially accelerated by radiation at both wavelengths, although the rates obtained for dimethyl sulfide were appreciably slower than those for methyl mercaptan and dimethyl disulfide under the same conditions. In the oxidation of methyl mercaptan, one of the first products was dimethyl disulfide, which was then further oxidized. Sulfur dioxide was produced by the oxidation of both methyl mercaptan and dimethyl sulfide. (Author abstract modified)

1625 APTIC NUMBER 18095

Reinke, William A.
MULTIVARIABLE AND DYNAMIC AIR POLLUTION MODELS. Arch. Environ. Health, 18(4):481-484, April 1969. 3 refs.

In air pollution studies large numbers of independent variables which are related to one or more dependent variable of interest are encountered. The multiple regression technique is an oft used vehicle for the analysis of these associations. Specific application of multiple regression analysis and spectral analysis in the construction of air pollution models are discussed.

1626 APTIC NUMBER 16582

Ruff, I.
THE THEORY OF THERMAL ELECTRON-TRANSFER REACTIONS IN SOLUTION. Quart. Rev. (London), 22(2):199-221, 1968. 45 refs.

The theoretical treatments for homogeneous electron-transfer reactions with reference to heterogeneous electrode reactions are reviewed. Experimental results are compared. At the present stage, there is no direct proof of the correctness of one of the activated complexes supposed, so the applicability of a model can be judged from two view points: which model is more plausible; and which can predict results in satisfactory agreement with experiments over a broader range of parameters and reactions. Numerous charts, tables, illustrations, and mathematical formulae are given. The Franck-Condon principle and its application for radiationless transitions; the outer sphere mechanism; and the inner sphere mechanism are discussed in length. It is concluded that the theories reviewed show essential differences in the model of electron-transfer reactions, and it is clear that the grounds of the detailed mechanism are revealed. The phenomena affecting the rate of these processes are, in general: the collision of the reactants; the rearrangement of the environment; and the probability of the electronic jump. An ab initio quantum mechanical treatment would be the most sophisticated theoretical approach, but its results would be individual which is never the purpose of any theory. Further development can be expected to be based on refinement of the approximations used so far, perhaps with a unification of the advantageous properties of the various theories. It will be desirable to retain general validity, since the purpose is to understand and explain the experimentally observed behavior of oxidation-reduction reactions and not to replace measured values with calculated ones.

1627 APTIC NUMBER 17800

Schmidt-Nickels, Wilhelm
ACTION OF SULFUR DIOXIDE ON HALOGENMAGNESIUM DERIVATIVES OF CARBINOL. (Ueber die Einwirkung von Schwefeldioxyd auf die Halogenmagnesyl-Derivate von Carbinolen). Text in German. Chem. Ber., 62B:917-919, 1929. 9 refs.

Derivatives of aromatic O-sulfinic acids were prepared and their properties were studied. For this purpose the halomagnesium derivatives of carbinol were reacted with sulfur dioxide. The magnesium bromine compound of the triphenyl carbinol which develops from benzophenone and phenyl magnesium bromide absorbs SO2 readily and forms (C6H5)3C.O.SO2.MgBr. The latter compound dissociates in water to water soluble magnesium bromide and to an insoluble crystalline substance which is halogen-free. According to its properties, it is the magnesium salt of the triphenyl-methyl-oxy-sulfinic acid ((C6H5)3C.O.SO2) 2Mg. The bromine magnesium compound of the 9-phenyl-fluorenole-(9) has the same properties as that of the triphenyl carbinol. The compound (CH3)(C6H5)2C.O.SO2.MgJ, however, has quite different properties. It dissociates in water to a hydrocarbon C28H24 (melting point 113-114 C), with the structure (CH3)(C6H5)2C.CH:C(C6H5)2 and into HO.SO2.MgBr.

1628 APTIC NUMBER 17443

Schumacher, H. J. and J. Stauff
CONTRIBUTIONS TO THE KNOWLEDGE OF THE REACTIONS OF HYDROCARBONS WITH SULFURYL CHLORIDE AND SULFUR DIOXIDE-CHLORINE MIXTURES. (Beitraege zur Kenntnis der Reaktionen von Kohlenwasserstoffen mit Sulfurylchlorid und Schwefeldioxyd-Chlor-Gemischen). Text in German. Angew. Chem., vol. 55:341-345, 1942. 21 refs.

Systematic investigations in the field of sulfochlorides of hydrocarbons previously begun were to include reaction mechanisms. The chemical structure of the reaction products, and determinations of the physical and chemical properties of the latter. Most of these studies had to be discontinued; in the present paper, pertinent new results are reviewed. The results of Kharasch and collaborators on chlorination of hydrocarbons with sulfurylchloride in the presence of peroxides are discussed. It is highly probable that at least a large share of the chlorination involves molecular Cl. The peroxide merely plays the same role as light. The reaction of radicals evolved by it with Cl molecules yields Cl atoms. The radicals formed by the reaction of Cl atoms with the hydrocarbon then react in the familiar manner with the always present free Cl. The study of the photochemical formation of sulfochlorides by SO2Cl2 in the presence of pyridine also made by Kharasch is supplemented and corrected. The kinetics of the photochemical sulfochlorination of n-heptane by SO2 + Cl2 mixtures in a CCl4 solution in complete absence of fat and O2 was studied by a method described in detail in the paper. As a result, the following reaction schemes are proposed: 1)Cl2+h.nu equals Cl+Cl; 2)C7H16+Cl equals C7H15+HCl; 3)C7H15+SO2 equals C7H15SO2; 3)C7H15+Cl2 equals C7H15Cl+Cl; 4)C7H15SO2+Cl2 equals C7H15SO2Cl + Cl; 5)Cl+Cl equals Cl2.

1629 APTIC NUMBER 17742

Seiyama, Tessuro, Akio, Suenaga, and Wataru Sakai
THERMODYNAMIC CONSIDERATIONS ON THE CONTACT OXIDATION OF CARBON MONOXIDE AND SULFUR DIOXIDE. (Issanka-tanso oyobi aryusan gasu no sesshoku-sanka-hanno no netsurikigaku-teki kosatsu). Text in Japanese. Nippon Kagaku Zasshi (J. Chem. Soc. Japan), 82(3): 292-298, 1961. 10 refs.

The contact oxidation of carbon monoxide or sulfur dioxide using metal oxide catalysts is determined by the mechanism of oxidation and reduction of the catalyst(s). The ranking of catalystic activities in the oxidation of CO was similar to those in other articles: Mn2O3, V2O5, CuO, Co3O4 greater than Fe2O3, NiO, CoO greater than TiO2, ZnO, Cr2O3 greater than ThO2, Al2O3, MgO at 500 K. The catalytic activity of V2O5 in the oxidation of SO2 was due to its semi-conducting characteristics. Equilibrium of these reactions were determined by the relationship of oxygen amount and the ratio of CO/CO2 or SO2/SO3; the thermodynamic characteristics of the catalysts were discussed.

1630 APTIC NUMBER 17569

Shaffer, J. H., W. R. Grimes, and G. M. Watson
BORON TRIFLUORIDE AS A SOLUBLE POISON IN MOLTEN SALT REACTOR FUELS. Nucl. Sci. Eng., vol. 12:337-340, 1962. 7 refs.

The solubility behavior of gaseous boron trifluoride (BF3) in a molten fluoride mixture suitable for Molten Salt Reactor Experiment (MSRE) application was determined as a function of pressure and temperature. The MSRE is a 10 Mw (th) circulating fuel reactor moderated with unclad graphite in contact with a mixture of molten fluoride salts containing uranium tetrafluoride. Values of Henry's law constants were obtained (in moles of BF3 per liter of solution per atmosphere) of 0.265, 0.145, 0.0846, and 0.0351 at 500, 600, and 700 C, respectively. These high solubilities indicate that BF3 should be suitable for control purposes of a molten salt reactor even at very moderate partial pressures. At reactor temperatures, and with a BF3 partial pressure of one atmosphere, an average atomic ratio of boron to U(235) of 0.8 in the liquid was estimated. Simplified calculations of the distribution of boron between the fuel and the graphite moderator were made, and indications obtained, neglecting adsorption effects, that 85% of the boron would remain in the liquid even assuming coppplete equilibrium intrusion of the graphite pores by gaseous BF3. Various related problems are listed which remain to be investigated before the use of BF3 can be recommended for the MSRE. (Author abstract modified)

1631 APTIC NUMBER 11938

Simpson, Maurice H.
RESEARCH ON THE EFFECTS OF TEMPERATURE AND HUMIDITY ON OZONE CONCENTRATIONS. Frankford Arsenal, Philadelphia, Pa., Quality Assurance Directorate, AMCMS 5027.11.701, Proj. 1A025001A622.19, Rept. R-1754, 34p., April 1965. 18 refs.
DDC: AD 464780

Investigations were carried out in a laboratory ozone test facility to determine if humidity has any effect on the decompostion rate of ozone at normal atmospheric temperatures and pressures and, if so, to develop relationships that would describe that effect. Specifications of the ozone test cabinet are given. A constant ozone generation rate was maintained while controlling temperature at 50, 70, 80, and 100 F and controlling humidity at specific dewpoint temperatures from 0 F to 65 F. Ozone concentrations were not significantly affected by atmospheric temperatures within the environment of the troposphere, but were affected by the relative amount of moisture present. An increase in humidity will cause a decrease in ozone concentration; an equation is given for approximately this relationship. The results are related to the design of future laboratory ozone test facilities, and recommendations for future research are made. An appendix includes a review of the literature on temperature and humidity effects on ozone, and a presentation of experimental data from the present experiments.

1632 APTIC NUMBER 16603

Sokol'skiy, G. A. and I. L. Knunyants
SULFOTRIOXIDATION OF POLYCHLORETHYLENES. (Sul'fotrioksidirovaniye polikhloretilenov). Text in Russian. Izv. Acad. Nauk SSSR, Ser. Khim., no. 9:1655-1657, 1965. 9 refs.

In the course of an experimental study of reactions of sulfur trioxide with polyhaloidolefins, the processes of sulfotrioxidation of tetrachlorethylene and fluortrichlorethylene was determined, as well as of thermolysis of sulfochloridedichloracetylchloride, sulfofluoridedifluoracetylfluoride. In every case, a brief description of the experimental procedure and of its results is given. In contrast with the previously studied processes of sulfotrioxidation of difluordichlorethylene, trifluorchlorethylene, and tetrafluorethylene, those of sulfotrioxidation of tetrachlorethylene and fluortrichlorethylene required the use of an autoclave and of reaction temperatures of 180 to 200 and 160 to 180 C, respectively, and yielded trichlorethylen and fluordichlorethylene under formation of SO2. This behavior may be ascribed to steric factors, in particular, to screening of the multiple bond of olefine by Cl atoms, the atomic volume of which is considerably greater than those of F and H atoms. The last mentioned two processes may take place in three stages involving the intermediate formation of Cl-bearing ethane-beta-sulfone, its isomerization into a sulfohalogenidedichloracetylchloride, and the thermal dissociation of the latter under formation of SO2. The possibility of occurrence of the first two stages is strongly suggested by known precedents. The occurrence of the third stage was confirmed by the results of thermolyses carried. The course of reactions with SO3 with polyhaloidolefins is determined by several factors: the extent of screening of the multiple bond of olefine, the isomerization tendency of the resulting haloid-bearing beta-sulfone, and the thermal stability of the latter.

1633 APTIC NUMBER 18086

Spurny, Kvetoslav R., James P. Lodge, Jr., Evelyn R. Frank, and David C. Sheesley
AEROSOL FILTRATION BY MEANS OF NUCLEPORE FILTERS: STRUCTURAL AND FILTRATION PROPERTIES. Environ. Sci. Technol., 3(5):453-464, May 1969. 19 refs.

A new type of filter material, a porous, analytical filter trade-named Nuclepore, has been developed. This resembles membrane filters in many of its properties, such as the relationship between air flow rate and pressure drop. One previously developed theory of filtration by membrane filters approximated their structure as a group of parallel capillaries. This model appeared to be an exact description of the structure of Nuclepore filters. Accordingly, the filtration properties of Nuclepore were determined and compared with an extension of the previous filtration theory. Both the initial performance and the change in properties caused by previously collected material were adequately accounted for by the theory. (Author's Abstract)

1634 APTIC NUMBER 17838

Sryvalin, I. T.
THERMODYNAMIC PROPERTIES OF CAO-AL2O3-SI2 MELTS.
Termodinamicheskiye svoystva rasplavov sistemy CaO-Al2O3-SiO2).
Text in Russion. In: Forsirovaniye Domennoy Plavki. Trudy
Nauchnoy Konferentsii po Tedreticheskim Kolrosam Metallurgii
Chuguna, Dnepropetrovsk, 1961. Metallurgizdat, Moscow, 1963,
p. 107-111. 15 refs.

Simple corrections are applied to equations for ordinary solutions to derive equations for calculating the activities of components in calcium oxide-aluminum trioxide-silicon dioxide melts. First-approximation equations reflect the effects of peculiarities of the melt structure (the presence of binding and polymerization) on the heat of mixing, and are capable of describing systems with systematic deviations from ideal solutions. The activities of CaO and SiO2 determined from these equations are in satisfactory agreement with available experimental data. Considerable deviations in calculated values for Al2O3 are explained by noticeable concentrations of magnesium oxide in test slags.

1635 APTIC NUMBER 17790

Stern, K. H. and E. L. Weise
HIGH TEMPERATURE PROPERTIES AND DECOMPOSITION OF INORGANIC SALTS.
PART 1. SULFATES. Natl. Bur. Std. (U. S.) Natl. Std. Reference
Data Ser. no. 7, 39p., Oct. 1, 1966. 145 refs.

The literature dealing with the high-temperature behavior of 60 inorganic sulfates is critically reviewed. Free energy functions of reactants and products of the decomposition reactions were calculated, and are tabulated from 298 K up to as high a temperature as possible. Free energy functions, equilibrium constants of reactions, and partial pressures of gaseous components are also tabulated. Auxiliary data on phase transitions, densities, and kinetics of chemical decomposition are given. For user convenience, a number of special tables are included: relative thermal stability of some sulfates; Arrhenius activation energies for the thermal dissociation of some inorganic sulfates; melting points in increasing order; and boiling points. (Author abstract modified)

1636 APTIC NUMBER 12150

Stuart, B. O., M. D. Snyder, W. J. Bair, and M. S. Porter
IMPROVED RESPIRATORY VALVES FOR INHALATION STUDIES. In: Hanford
Biology Research Annual Report for 1964. Battelle-Northwest,
Richland, Wash., Pacific Northwest Lab., AEC Research and
Development Dept., p.29-32, Jan. 1965.
CFSTI: BNWL-122

Two new types of respiratory valves were developed for use in inhalation depostion studies with large experimental animals. The first valve, mounted with a linear activator to drive it, was made with a slide in the shape of a cylinder, thus minimizing surface contact area and allowing much closer machining tolerances; consequently it operated with much less friction and was found to be virtually air-tight when used in subsequent animal experiments. An external guide was incorporated to eliminate any tendency of the slide to rotate. The second valve was a rotary-action valve designed to further reduce the surface-to-surface area and to provide a minimum of moving weight during operation. The valve interior rotates through 62 degrees upon actuation of the rotary solenoid mounted above it. At the end of expiration, a scroll-type spring returns it to the inspiratory position. This valve is less than 6 in. high and can be positioned either horizontally or vertically with respect to the aerosol chamber and animal. A schematic design of an electronic switch and control unit that was developed to operate these valves was also presented.

1637 APTIC NUMBER 18091

Thomas, N. T., L. S. Caretto, and Ken Nobe
CATALYTIC COMBUSTION OF CARBON MONOXIDE ON COPPER OXIDE. Ind.
Eng. Chem. Process Design Develop., 8(2):282-287, April 1969.
21 refs.

The effect of CO2 on the catalytic combustion of CO on copper oxide was investigated. The CO2 content of the feed stream was varied from 0 to 10 percent with the total gas flow maintained constant at 400 liters (25 C., 1 atm.) per hour. The initial concentration of CO was varied from 300 to 1150 ppm, and reaction temperatures ranged from 60 to 134 C. Correlation of the experimental data with the simple power law rate equation showed that the reaction order increased from 0.3 to 0.8 for carbon dioxide concentrations ranging from 0 to 10 percent. A more general correlation of the kinetic data with a single rate equation for the entire range of CO2 concentration was achieved. (Author's Abstract)

1638 APTIC NUMBER 17513

Torbin, M. V. and D. F. Datsenko
THE ROLE OF THE 'MAKEUP' EFFECT IN THE PROCESS OF CONDENSATION
OF WATER VAPOR FROM AN AEROSOL FLOW ON THE SURFACE OF SOLUTIONS.
Colloid J. (USSR) (English translation from Russian of: Kolloidn.
Zh.), vol. 31: 609-611, Sept.-Oct. 1969. 6 refs.

In the past, the coefficient of absorption of the particles of an aqueous aerosol was found by measuring the increase in weight of the collector in flows of aerosol and saturated vapor (under identical conditions). The difference in these values was used to calculate the weight of the aerosol particles captured in unit time and their capture coefficient. Because the calculations incorrectly assumed that the rate of condensation of saturated water vapor did not increase in the presence of particles of an aqueous aerosol, the capture coefficient values derived were too high. Taking this 'makeup' effect into consideration, the kinetics of the absorption of an aerosol by solutions at small gas flow rates were studied. Equations were also obtained for quantitatively characterizing the rôle of the 'makeup' effect in the condensation mechanism. Experimental measurements of the total increase in weight of the collector in a flow of saturated vapor were in satisfactory agreement with the calculated theoretical values. It was established that mechanical capture of aerosol particles by the surface of a solution is completely absent at low gas flow rates.

1639 APTIC NUMBER 17572

Ulbrich, E. A. and R. A. Jones
SIMULATION LOW-CONCENTRATION CHEMICAL REACTIONS AS IN SMOG.
Simulation, 12(4):185-189, April 1969. 8 refs.

In order to verify the mathematical model from a chemical chamber experiment and to explore the feasibility of modeling chemical reactions by computer, a simulation was performed of the photochemical production of smog components in the presence of ethylene and oxygen. The problem was time-scaled fast by a factor of 1440, so that the 24-hr experiments could be run in one minute. The study using a hybrid computer, was considered a success in that the time histories of the significant measured chamber variables could be reproduced closely. The simulation is considered a valuable tool in two ways: the values of the rate coefficients can be more closely estimated, and it can be used for many routine runs in place of the relatively expensive laboratory chamber. The principle criticism of the method is that the solution cannot be proved unique. Additional advantages are rapid response, recording of all reactants, and insight into the reactions by the application of data gained from a computer model. It also serves to indicate areas for additional research in the laboratory chamber. (Author conclusions modified)

1640 APTIC NUMBER 18090

Urone, Paul and William H. Schroeder
SO2 IN THE ATMOSPHERE: A WEALTH OF MONITORING DATA, BUT FEW REACTION RATE STUDIES. Environ. Sci. Technol., 3(5):436-445, May 1969. 70 refs.

Sulfur dioxide in the atmosphere has been the subject of many monitoring studies on a routine basis. However, very few reaction rate studies, which would provide a vital clue to the chemistry of polluted atmospheres, have been reported on. The complex nature of polluted atmosphere makes it difficult to reproduce in the laboratory, so controlled experiments have been somewhat unsuccessful. This article reviews the literature on atmospheric SO2 reactions. A tabular presentation summarizes the findings of 14 sets of experimental data.

1641 APTIC NUMBER 12180

Vaishnavi, Bihari Lal
THEORETICAL ANALYSIS OF INITIAL VELOCITY EFFECTS IN TURBULENT DISPERSION OF DISCRETE PARTICLES. Ohio State Univ., Columbus, Dept. of Agricultural Engineering, Thesis (Ph.D), Ann Arbor, Mich., Univ. Microfilms, Inc. 1967, 59p. 33 refs.

The motion of a large cluster of small, spherical-shaped discrete particles, having a non-zero initial velocity, in a turbulent, fluid-flow was investigated. A modified version of the turbulent diffusion equation of Batchelor was suggested for determing the concentration of the discrete particles. This equation, under the specification of appropriate boundary conditions, could be solved for the concentration of diffusing particles, provided the mean velocity of the particles relative to that of the ambient fluid, and the turbulent diffusivity of the discrete particles was known. To this end, an integro-differential equation was established for the instantaneous velocity of a spherical particle moving in a turbulent fluid under the action of a constant external force field such as gravity. A necessary condition for neglecting the effect of fluid inertia and viscous forces was small particle size. The stochastic, integro-differential equation for particle motion was formally solved for the instantaneous particle velocity, and from this solution, the statistics of particle motion, the mean velocity and, in particular, the turbulent diffusivity, were obtained. Unlike the case of particles starting from rest, the particles had a mean motion which was not constant, but depended strongly on time. This velocity was a function of initial fluid velocity and buoyancy forces, but independent of the initial particle velocity for asymptotically large times. The turbulent diffusivity of particles was a linear combination of negative exponential functions if the Lagrangian (time) velocity correlation for the ambient fluid was assumed to be of exponential type. (Author summary modified)

1642 APTIC NUMBER 17529

Watanabe, Motoo and Toshiaki Yoshida
STUDIES ON ROASTING SULFIDE ORES. (II) ROASTING OF ZNS IN THE ATMOSPHERE WITH HIGH PARTIAL PRESSURE OF SO2. (Ryukako no baisho ni kansuru kenkyu (dai 2 ho) Aryusangasu bunatsu no takai kiken deno ryukaaen no baisho). Text in Japanese. Tohoku Daigaku Senko Seiren Kenkyusho Iho (Bull. Res. Inst. Mineral Dressing Met.), 18(2):131-140, Dec. 1962. 5 refs.

Experiments were performed on roasting zinc sulfide at 450 to 750 C in mixed gas atmospheres of 13 to 18% of O2, 12 to 35% of SO2, and in the air. The sample was prepared by recrystallizing a reagent of extra pure grade in a process involving precipitation from ammonium acetate buffer solution. Its analysis was 65.84 Zn and 31.93% S (Zn/S equals 2.06). The theoretical values are 67.09, 32.91, and 2.03 respectively. The products, at low temperature or in the gas containing a large quantity of sulfur dioxide, are rich in the basic sulfate or in zinc sulfate, but most of those produced by roasting at high temperatures are zinc oxide. When zinc sulfide was roasted at high temperature, and in the atmosphere containing much sulfur dioxide, zinc oxide was produced. When zinc sulfide almost disappeared, zinc oxide turned into a basic sulfate by the gas contained in the atmosphere. When roasting was continued, the basic sulfate changed to zinc sulfate. Weight change and the rate of reaction are graphically shown as a function of reaction time for several kinds of the mixed gas atmospheres tested.

1643 APTIC NUMBER 17364

Wickert, K.
TESTS ON FORMATION OF FECL2 AND FECL3 BY REACTIONS BETWEEN FE, FE304, FE203 AND HCL-CONTAINING GASES. (Versuche zur Bildung von FeCl2 und FeCl3 aus Fe, Fe304, Fe203 und HCl-haltigen Gasen). Text in German. Mitt. Ver. Grosskesselbesitzer, 49(6):449-52, Dec. 1969. 5 refs.

The reaction of hydrogen chloride containing gases with pulverized Fe, Fe304, and Fe203 was studied with respect to temperature. Moreover, the influence of water vapor and oxygen in the HCl-containing gases on the raction with the above mentioned substances was studied with respect to temperature. For each experiment, 0.3 g of the pulverized substances were heated in the presence of pure nitrogen. Each experiment lasted 4 hours. The HCl-containing gas (100 cu cm/min) was passed with a speed of 0.44 cm/sec through the reaction chamber at a temperature of 22 C. The reaction products were cooled to room temperature and the weight changes of the substances were determined. The reaction of Fe203 with N2 containing 5% by volume HCl forms FeCl3. The fraction of solid FeCl3 decreases with increasing temperatures while the volatile FeCl3 increases with the temperature. Below 320 C, volatile and solid FeCl3 are formed. The reaction of Fe with the gas forms FeCl2. Above 670 C, no solid FeCl2 is found. Above 580 C, FeCl2 is increasingly sublimated. The reaction with Fe304 forms FeCl2 and FeCl3. The former develops primarily at low temperatures. The maximum FeCl2 formation takes place between 200 and 250 C. The FeCl3 is sublimated at 300 C. The reaction of Fe304 with N2 containing 10% H20 and 5% HCl forms solid FeCl2 up to 550 C. No reaction takes place between 550 and 700 C. Above 300 C, FeCl3 and FeCl2 form which are immediately converted to Fe203 through the influence of water vapor. The reaction with Fe forms no Fe203 only Fe304. Oxygen in the gas like the water vapor impairs the HCl reaction with Fe, Fe203, and Fe304. The presence of water vapor in addition to HCl form volatile and non-volatile chlorides but to a much lesser extend than in the presence of HCl alone in the gas. Oxygen further reduces chloride formation.

1644 APTIC NUMBER 12265

Wiebe. H. A. and Julian Heicklen
THE PHOTOLYSIS OF THIOPHENE VAPOR. Preprint, Pennsylvania State Univ., University Park, Center for Air Environment Studies and Pennsylvania State Univ., University Park, Dept. of Chemistry, 41p., 1968. 15 refs.

Thiophene vapor was photoexcited with 2139 and 2288 A radiation as well as by mercury sensitization at 2537 A. Experiments were performed at 25, 200, and 305 C at various pressures and light intensities as well as in the presence of CO2, C2H4, butenes, and O2. In all cases, the products were C2H2, CH2CCH2, CH3CCH, CS2, CH2CHCCH, and polymer. When O2 was present, CO2, COS, SO2, and CO were also produced. The product quantum yields decreased as the pressure increased. A reaction mechanism was deduced. The initially formed excited state, Th*, as well as the excited intermediate leading to CH2CCH2 production, I*, decomposed at a rate dependent only on the total energy content, regardless of whether it was thermal or photolytic. The efficiencies for energy removal from both Th* and I* decreased along the series:thiophene, C2H4, CO2, and O2. Appropriate rate constant ratios for all the gases were obtained. Experiments in the presence of olefins showed that sulfur atoms were not intermediates. The experiments with O2 further eliminated a number of possibilities. The hydrocarbons are all produced in primary processes with additional CH2CHCCH and C2H2 coming respectively from the postulated intermediates CHCHCHCHS and C2H2S. Along with the C3 hydrocarbons, excited CS species are produced. They can either react with the above intermediates to produce CS2 or be deactivated to eventually form a polymer (or oxidation products in the presence of O2). (Author abstract modified)

1645 APTIC NUMBER 17801

Wright, R. H.
ODOUR AND MOLECULAR VIBRATION. Nature (London), 209(5023):571-573, Feb. 5, 1966. 2 refs.

The postulates of the vibrational theory of odor are elaborated and applied to an investigation of benzonitrile, a substance with bond-defined molecules and known normal-mode spectroscopic frequencies which has a distinctive bitter-almond smell. To identify the osmically active frequencies, its possible 'populated frequencies' are given and collated with similar values for nitrobenzene and benzaldehyde, which have similar odors. Results indicate an apparent association of osmic activity with out-of-plane oscillations of the benzene rings. Three criteria of osmically active vibrations are hypothesized: they must have low frequency; they must involve all or most of the molecule; and they must have substantial components perpendicular to the receptor surface. Information theory suggests that the whole array of smells derives from about 25 primary odors; if the almond odor is due basically to the three frequencies deduced in the experiments, it is a three-primary odor. Other odors would presumably correlate with other combinations of frequencies, although this has not yet been demonstrated. It is concluded that the vibrational theory should include the understanding that two normal modes can be excited in the same molecule at the same time, and that when this occurs, the result must be a new frequency which is the difference between the frequencies of the two normal modes.

1646 APTIC NUMBER 16585

Yemelin, V. P., Ye. K. Zolotarev, and A. M. Yudin
KINETICS OF ABSORPTION OF SULFURIC ANHYDRIDE DURING SULFONATION OF NITROBENZENE BY GASEOUS SO3. (Kinetika pogloshcheniya sernogo angidrida pri sul'firovanii nitrobenzola gazoobraznym SO3). Text in Russian. Khim. Prom. (Moscow), no.1:30-31, 1965. 7 refs.

Ambient air pumped into an air tank, passed through a rheometer at a volume rate of 2.37 l/hr, and bubbled through a 60% solution of H2S207 in a jar immersed in an oil thermostat became saturated with sulfur trioxide in a concentration between 56.5 and 75.5% depending on the preset oil-bath temperature. The SO3-saturated air, kept warm while flowing through an electrically heated transfer tube, then bubbled through 10 ml of nitrobenzene in a jar immersed in a water thermostat at a pre-set waterbath temperature between 40 and 80 C. The air was stripped of any remaining SO3 in bubbling through a 98% solution of H2SO4. The amount of SO3 absorbed was determined by weighing the jar with nitrobenzene before the test and every 5 minutes during the test. It was found to be practically independent of the water-bath temperature within the adopted limits. For each SO3-concentration of SO3-saturated air, the relative amount of absorbed SO3, in grams per 1 gram of nitrobenzene, increased linearly with the test duration considerably beyond the sulfonation of nitrobenzene. The rate of absorption of SO3 by nitrobenzene, V in grams/gram min, varied with the SO3 concentration in SO3-saturated air, C in %, as specified by the empirical relation V equals 5.37 times 10 to the minus 8th power times C to the 3.1 power. The first findings suggested that the rate of SO3 absorption by nitrobenzene is higher than the rate of its sulfonation by SO3, resulting in the formation of m-nitrobenzene sulfo acid. This was confirmed by additional tests in which SO3-saturated air was bubbled through nitrobenzene for 25 minutes only. The content of free nitrobenzene in the resulting product, subsequently determined at 5 minute intervals, was found to continue decreasing exponentially with time for at least another 20 minutes. The investigated method of nitrobenzene sulfonation by gaseous SO3 is well-suited for continuous production of m-nitrobenzene sulfo acid.

1647 APTIC NUMBER 16774

Amdur, Mary O.
TOXICOLOGIC APPRAISAL OF PARTICULATE MATTER, OXIDES OF SULFUR, AND SULFURIC ACID. J. Air Pollution Control Assoc., 19(9):638-646, Sept. 1969. 62 refs.

An examination of the available toxicological literature indicates that sulfur dioxide itself would be properly classified as a mild respiratory irritant, the main portion of which is absorbed in the upper respiratory tract. The literature further indicates that sulfuric acid and irritant sulfates, to the extent that the latter have been examined, are more potent irritants than SO_2. The irritant potency of these substances is affected by particle size and by relative humidity, which factors are probably interrelated. There is evidence, based on animal experiments of one investigator, indicating that the presence of particulate matter capable of oxidizing SO_2 to H_2SO_4 caused a three to fourfold potentiation of the irritant response. The aerosols causing this potentiation were soluble salts of ferrous iron, manganese, and vanadium all of which would become droplets upon inhalation. Insoluble aerosols such as carbon, iron oxide fume, triphenylphosphate, or fly ash did not cause a potentiation of the irritant of sulfur dioxide even when used at higher concentrations. The concentrations of SO_2 used in these various experiments were in some cases as low as 0.16 ppm. The catalytic aerosols were used at concentrations of 0.7 to 1 mg/m^3 which is above any reported levels of these metals in urban air. If the SO_2 present as an air pollutant remained unaltered until removed by dilution, there would be no evidence in the toxicological literature suggesting that it would be likely to have any effects on man at prevailing levels. Studies of atmospheric chemistry have shown that SO_2 does not remain unaltered in the atmosphere, but is converted to H_2SO_4. Such a conversion increases its irritant potency. On this basis, the toxicological literature combined with the literature of atmospheric chemistry suggest that sulfur dioxide levels be controlled in terms of the potential formation of irritant particles. Therefore control measures should be, as far as feasible, aimed at both SO_2 and particulate material and not against either alone. This article is followed by a discussion by J. Wesley Clayton, Jr. (Author's Abstract Modified)

1648 APTIC NUMBER 11630

Antal, Andrei, Jeanette Timaru, Elena Muncaci, Ecaterina Ardevan, Ala Ionescu, and Lia Sandulache
VARIATIONS OF THE ORGANISM REACTIVITY AND THE STATE OF HEALTH OF CHILDREN IN REGARD TO TOWN AIR POLLUTION. (Les variations de la reactivite de l'organisme et de l'etat de sante des enfants en rapport avec la pollution de l'air communal). Atmos. Environ., 2(4):382-392, 1968. 33 refs. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 20p.

Organism reaction and state of health of the child population in a metallurgical center where atmospheric lead concentrations exceeded prevailing sanitary standards was studied in various investigations (clinical, somatometric, capillaroscopic, nerve reactivity, adaption disturbance, psychometric, etc.) In a parallel manner, children in a control city where the air was relatively pure were examined. The observations were made on varying numbers of children, according to the kind and character of the tests. Antropometric tests were applied to 2310 children, dynamometric to 1702, capillaroscopic to 1658, and tests of neuropsychic activity to 258-948 children. The data obtained indicate a decreased resistance of the respiratory apparatus to pathogenic agents on the part of the children in the polluted city. In particular, upper respiratory tract infections, pneumonia and bronchopneumonia, anemia, avitaminosis, rachitis, disorders of the digestive tract, and dental decay were more frequent by 9 to 31%. In addition, the children exhibited poorer psychical and physical development, more frequent adjustment problems, reduced scholastic performance, and greater frequency of aberrant capillaries. The degree of air pollution reaction differences was found to be related not on the extent of pollution, but also to the degree of development, sex, age, biological condition of the subjects, and duration of exposure. Sensitivity was greater in girls and preschool children, and proportional to the length of exposure to pollutants.

1649 APTIC NUMBER 11982

Babayants, R. A.
INFLUENCE OF URBAN AIR POLLUTION ON THE HEALTH OF INHABITANTS. Vestn. Akad. Nauk SSSR, 14(12):3-12, 1959. 15 refs. Translated from Russian. 15p.

A survey of the influence of air pollution in general and of several air pollutants (carbon monoxide, sulfur dioxide, fluorides, aerosols) on the health of humans in the U.S.S.R., is given. The first study dates back to 1933 and has become important primarily for the method used. The first broad study was conducted in 1948-1949 where relationship between the incidence of lung, throat and tonsil pathology and air pollution was established as 1.5 to 8.1 times higher in the polluted area than in the control area. Subsequently, a clear relationship between eye disease and air pollution could be established. A study of school children in polluted and non-polluted areas revealed that changes of the lung image were five times as common among the children in the polluted area. In later studies, catarrhs, tonsilities, influenza and bronchitis were related to air pollution. A regional investigation conducted in Baku in 1955 revealed a correlation between bronchitis and laryngotracheitis and air pollution by aerosols. Similar results were obtained in a study in 1954-1955 in the Ukraine. A study of the influence of CO on traffic officers revealed that 68% of the officers exposed to concentrations of 25 mg CO/cu m had a carboxyhemoglobin of 11%. Tests in gas-heated apartments revealed a similar high incidence of CO intoxication. An investigation of the effects of SO_2 on animals revealed that respiratory disturbances began to develop at 2 mg/cu m. The increase of lung cancer is attributed to carcinogenic pollutants such as 3,4-benzpyrene. A higher number of persons with mottled teeth from the effects of fluorine emissions were found close to the source than at more remote distances from the source.

1650 APTIC NUMBER 12296

Balashev, B. N.

FREQUENCY ANALYZER FOR CEREBRAL ELECTRICAL ACTIVITY. (Chastotnyi analizator - periodmetr elektricheskoi aktivnosti golovnogo mozga). Hyg. Sanit., 33(7-9):225-229, July-Sept. 1968. 1 ref.

An instrument for frequency analysis of electroencephalograms, considerably simpler than existing designs and constructed with standard components, is described. The device can be used with any kind of electroencephalograph and has particular applicability to the testing of the biological effects of air pollutants. The results of frequency analysis are recorded on the electrogram, beneath the curve of the EEG, as a graph of the frequency dependence of EEG with respect to time and count pulses; the graph amplitude characterizes the duration of the mean period (mean frequency of EEG for the time-period analyized). For calibration of the readings of the analyzer, the instrument provides a calibration signal generator which makes it possible to read results in absolute units, i.e., in seconds and cycles. The use of the frequency analyzer in conjunction with an integrator permits a continuous multichannel recording during an experiment of the activity of the subject's cerebral biocurrents along with a simultaneous automatic qualitative and quantitative analysis of this activity. (Author conclusions modified)

1651 APTIC NUMBER 12116

Beckett, John C. and Albert P. Krueger
EXPERIMENTS WITH AIR IONS ON THE TRACHEA. Preprint, Inst. of Electrical and Electronics Engineers, New York, 12p., 1960. 16 refs. (Presented at the IEEE (Institute of Electrical and Electronics Engineers) Winter General Meeting, New York, Feb. 14, 1960.)

Animal experiments were performed to study the effect of small air ions on the surface-clearing efficiency of the trachea as measured by the rate of mucus flow and the beat rate of the microscopic hair-like protrusions called cilia. Air ions were generated in a moist chamber by a portable ion generator containing an ion source of tritium gas sealed in zirconium deposited on stainless steel foil; ions received on the tissue were measured by a modified ionization flow meter of the target collector type. Moderate densities (1 time 10,000,000/sq cu/sec) of positive ions acting for 20-30 min produced striking effects on the functioning of the trachea. Ciliary activity dropped by several hundred beats per minute or frequently stopped altogether, while the rate of mucus flow diminished. Positive ions contracted the posterior wall of the trachea, dried the mucosal surface, and induced in the cilia a susceptibility to tissue damage. Negative ions accelerated ciliary activity and mucus flow above normal values and in general reversed the inhibitory effects of positive ions. The implication of these studies and related investigations are discussed; the findings have application to the design of electrical equipment for use in confined spaces, such as nuclear submarines and space ships, and in the basic studies of electrical effects on cells and tissue.

403 APTIC NUMBER 11964

Belli, R., V. Giuliani, and S. Zazo
RELATION BETWEEN THE ALBUMIN AND CHOLINESTERASE LEVELS IN EXPERIMENTAL INTOXICATION WITH TETRAETHYL LEAD. (Rapporto tra il tasso delle albumine e della acetilcolinesterasi nell'intossicazione sperimentale da piombo tetraetile). Rass. Med. Sper., vol. 2:220-224, 1956. 17 refs. Translated from Italian. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 8p.

Blood protein changes were studied in serum specimens from two groups of rabbits that had been given tetraethyl lead subcutaneously in daily doses of one and 10 mg/kg of body weight, respectively. Streptococcus vaccine (in formalin) was also injected into each animal on the 6th, 9th, 14th and 19th days after the beginning of intoxication. Some parallelism existed in the behavior of the serum albumin and cholinesterase values; the changes for both substances are considered to be related to a tetraethyl lead liver injury. However, it hypothesized that when hepatic lesions are combined with lesions of other parenchyma of decisive importance in plasma protein formation or in urinary enzyme elimination (e.g. the renal system or the reticuloendothelial system), the ratios between the two substances can no longer be maintained.

1653 APTIC NUMBER 18097

Biersteker, Klaas
AIR POLLUTION AND SMOKING AS CAUSE OF BRONCHITIS. AMONG 1000 MALE MUNICIPAL EMPLOYEES IN ROTTERDAM, NETHERLANDS. Arch. Environ. Health, 18(4):531-535, April 1969. 13 refs.

One hundred and eighty-one of the 1000 male municipal employees in Rotterdam, who were screened with a bronchitis questionnaire and a Wright-McKerrow peak flowmeter, stated that they suffered from a chronic morning cough. In the age group of 50- to 64-year-olds, the prevalence of more advanced symptoms of bronchitis was 14%. Smoking habits, years of residence in Rotterdam, years of residence in a nonurban environment, and postal district of present address were compared for 168 males over 30 years of age and having bronchitis symptoms with the same characteristics as those of a group of controls of similar age and background. A significant difference in percentage heavy cigarette smokers was found, but no differences in other characteristics. The tool to measure the effect of chronic air pollution may have been too blunt. In any case, there is enough evidence that chronic nonspecific lung disease among municipal employees in Rotterdam is a common problem, which requires new medical approaches in coming years. (Author's Summary)

1654 APTIC NUMBER 17847

Bils, Robert F.
ULTRASTRUCTURAL ALTERATIONS OF ALVEOLAR TISSUE OF MICE. III. OZONE. Arch. Environ. Health, 20(4):468-480, April 1970. 29 refs.

Young mice (4 days and 1 and 2 months old) were exposed to 0.6 to 1.3 parts per million ozone for six to seven hours per day for one or two days, and the morphological changes seen in the alveolar cells were both age- and dose-dependent. The youngest mice exposed for two days were most sensitive, while less extensive change was seen in the older animals exposed for one day. Most typical of the ozone damage was swelling, disruption, and breakage of the endothelium. Erythrocytes were sometimes crenated or had irregular surfaces. Many of the interstitial areas were disorganized and contained cell debris and lamellar membrane figures, and in many interstitial areas, the basement membrane had fragmented in the vicinity of the alveolar corner cells. Infrequently, the blood-air barrier was completely broken. (Author abstract modified)

1655 APTIC NUMBER 18109

Cassell, Eric J.
THE HEALTH EFFECTS OF AIR POLLUTION AND THEIR IMPLICATIONS FOR CONTROL. Law and Contemporary Problems, 33(2):197-216, Spring 1968. 49 refs.

A brief review of the health effects of air pollution has been presented. The nature of the biological problem itself and evidence of various lines of inquiry indicate that while many of the pollutants in urban atmospheres have demonstrable effects on health, the effects of air pollution as a whole are not explained by the individual constituents acting separately. Because of the multifactorial nature of air pollution and its effects, control based primarily on standards for individual pollutants may be inadequate to the problem. The proliferation of pollutant and manufacturing or other process changes makes fixed standards seem as inappropriate to the sources of pollution as they are to the health effects. Evidence is presented for a return to more broadly based control concepts. The need for re-examination of control concepts is enhanced by the fact that air pollution is a protype problem, typical of the complex interrelationships of public health problems in a modern industrial urban society. (Author's Summary)

1656 APTIC NUMBER 15717

RECOMMENDED AIR QUALITY STANDARDS BASED ON HEALTH EFFECTS. Clean Air Quarterly, 12(41):5-29, Dec. 1968. 52 refs.

Air quality standards based on health effects are desirable levels of air quality which, on the basis of present knowledge, are expected to prevent health hazards or health impairment due to air pollution. Air quality criteria are scientifically sound statements about air pollutant exposures and associated effects. While criteria may be defined at multiple levels, standards for any given pollutant will reflect a single level of air quality which is desirable. Recommended air quality standards and air quality criteria based on health effects are presented for oxidant or O_3, CO, SO_2, and particulate matter. The interrelationships of the standards and criteria are explored. A synopsis of air monitoring procedures used in California provides brief statements of the principle of the methods used in obtaining the existing data, the limitations of these methods, and suggestions concerning improved air monitoring devices.

1657 APTIC NUMBER 17564

Comroe, Julius H., Jr.
CENTRAL AND REFLEX CONTROL OF BREATHING. Anesthesia Analgesia Current Res., 46(4):367-376, July-Aug. 1967. 25 refs. (Presented at the 41st Congress of the International Anesthesia Research Society, Bal Harbour, Fla., March 5-9, 1967.)

The ways in which respiration can either be augmented or depressed are reviewed, and three important mechanisms regulating breathing are discussed in detail. They are the central response to carbon dioxide; the peripheral chemoreceptors; and vagal reflexes. The main central action of carbon dioxide is now believed to be not the center of the medulla but its higher anterolateral surfaces. These are the chromosensitive areas; they are sensitive to changes in the PCO_2 and the hydrocarbon concentration in their environment; when activated, they probably feed information to lower medullary centers just as the peripheral chemoreceptors feed information upward into the medulla. The location of the chemosensitive area explains the ventilation response that occurs when man inhales 5-10% carbon dioxide in air or oxygen; the suppression of the respiratory response to inhaled carbon dioxide by anesthetics and barbiturates; and the occurrence of hypoventilation or hyperventilation responses that are not indicated by arterial blood PO_2, PCO_2, and pH levels. Peripheral chemoreceptors in the caratoid and aortic bodies are stimulated by marked decrease in arterial blood pressure or local vasococonstriction. With regard to vagal reflexes, studies on man, before and after block of the cervical vagi, indicate that the pulmonary inflation reflex is weak but that the pulmonary deflation reflex may be responsible for some of the unpleasant symptoms of dyspnea.

1658 APTIC NUMBER 11945

Demole, V., T. von Fellenberg, A. J. Held, and H. Schmid
FLUORINE, DENTAL CARIES, AND THE THYROID GLAND. Bull. Schweiz. Akad. Med. Wiss. vol. 7:440-462, 1951. 8 refs. Translated from French. 31p.

Analyses of the soil, water, and plants and examinations of several groups of children between the ages of 7 and 15 with the same ethnological background in different parts of Wallis (Switzerland) showed a relationship between the environmental fluorine content and the fluorization of the hard dental tissues and their resistance to caries. In the Sembrancher area, where the drinking water contains 1.4 mg of fluorine/l, the resistance to dental caries is much higher than in children living in the vicinity of Le Chable where the fluorine content of the water is only 0.05 mg/l. Some white stains on the enamel of the children's teeth were observed in Sembrancher, but no definite relationship could be established between the high fluorine content of the water in this village. The development of the thyroid gland in children was about the same, whether they came from areas with fluorine-rich or fluorine-poor water. In the area richest in fluorine (Sembrancher), no goiters were observed in 15-year-old boys and girls who were native to the area and had drunk the water since birth. These facts permit confirmation of the existence of a biological iodine-fluorine antagonism.

1659 APTIC NUMBER 12191

Dokuchaeva, F. V. and N. I. Skvortsova
BIOLOGICAL EFFECT OF EXPERIMENTAL INHALATION OF LOW MANGANESE CONCENTRATIONS. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 16:98-104, 1966. 16 refs. (B. S. Levine, ed.)
CFSTI: PB 179141

Pure-bred white rats (9 males and 16 females) were exposed to manganese dust in an experimental inhalation chamber. Two series were conducted, each paralleled by a control series. The manganese dust consisted of 95% MnO2 dried at 100 C and ground to contain 82% of particles with a diameter of less than 5 micron. The rats were exposed to dust inhalation 5 to 6 hours daily for 6 months (first series) and for 7 months (second series). The MnO2 concentration in the air was 0.302 mg/cu m in the first series and 0.033 mg/cu m in the second series. Dust inhalation under the conditions of the first experimental series elicited pulmonary changes in the form of pulmonary tissue inflammation, disturbance of the pulmonary vascular system, and slight peribronchial and pericircular sclerosis of the pulmonary tissue. The second series of experiments elicited in female rats shifts in the albumin/globulin blood serum protein ratios. The lungs of both the male-female rats showed the presence of fine foci of MnO2 dust accumulations. Inhalation of air containing an average of 4.12 mg/cu m of MnO2 dust for a period of 5 months produced porphyrinuria in experimental male rats, a rise in whole blood cholinesterase activity, and a drop in the number of erythrocytes.

1660 APTIC NUMBER 12403

Dost, Frank N., Donald J. Reed, Arthur Finch, and Chih H. Wang
METABOLISM AND PHARMACOLOGY OF INORGANIC AND FLUORINE CONTAINING COMPOUNDS. Oregon State Univ., Corvallis, Radiation Center, Contract AF 33(615)-1799, Proj. 6302, Task 630202, AMRL-TR-67-224, 9 p., Aug. 1968. 47 refs.
CFSTI, DDC: AD 681161

Studies were made on rats of the toxicology and chemistry of several compounds considered for deployment as oxidizers in missile propulsion: nitrogen trifluoride, tetrafluorohydrazine, chlorine trifluoride, bromine pentafluoride, and oxygen difluoride. The lethality of each agent by inhalation was determined, using an exposure chamber, as well as estimates of lethality after intraperitoneal administration. Experimental evidence suggests that the lethal effect of interhalogens is by corrosive local destruction of pulmonary surfaces, resulting in failure of gas exchange. Oxygen difluoride is thought to pass intact into the pulmonary cells where it reacts with biochemical reducing systems to ultimately cause cell death and structural failure. This agent is considered one of the most lethal of all chemicals and the development of an antidote is considered of critical importance. The nitrogen fluorides both cause intrinsically lethal levels of methemoglobin formation, but other pharmacologic activity by these compounds or their derivatives may also contribute to their toxic activity. (Author abstract modified)

1661 APTIC NUMBER 18070

Douglas, J. S. and M. W. Dennis
HISTAMINE RELEASE BY AIR POLLUTANTS. Arch. Environ. Health, 18(4):627-630, April 1969. 6 refs.

Earlier studies have indicated that some of the effects of air pollutants are caused by the release of histamine in lung tissue. In vivo studies using spontaneously breathing guinea pigs were conducted to determine whether or not the functional changes due to the pollutants were similar to changes caused by histamine. In vitro studies using guinea pig lung and human lung were conducted to measure the histamine released from excised lungs during the exposure to pollutants. The data presented suggest that histamine release by air pollutants in guinea pigs is of minor importance. Only textile dust extracts appear to release large quantities of histamine from the human lung samples examined.

1662 662 APTIC NUMBER 11943

Faerber, E-P., A. Hoffmann, and G. Schmitz
LARGE-SCALE INVESTIGATIONS ON THE HARMFUL INFLUENCES OF AIR POLLUTION ON PUBLIC HEALTH. (Untersuchungen zum Nachweis schaedigender Einfluesse von Luftverunreinigungen auf die Gesundheit des Menschen an groesseren Bevoelkerungsgruppen). Oeffentl. Gesundheitsdienst, vol. 20:493-511, 1959. 13 refs. Translated from German. 20p.

Between the summer of 1957 and the fall of 1958, measurements of the degree of air pollution in the city of Oberhausen as well as in the rural district of Empel-Rees and Geldern were taken by the Institute of Hygiene in Gelsenkirchen. Traps were set out and their contents periodically analyzed as to the total amount of air pollutants, the sulfur content (calculated as sulfate), and the iron content. Air pollution was 5 times higher in Oberhausen than in the rural district. A relationship was thought likely between air pollution and the reduction of solar radiation and ultraviolet light by absorption. The disease rate of large groups of the population in both areas was also studied. Rickets in babies, between 3 and 5 months, occurred twice as frequently in Oberhausen as in the rural area. Serum phosphatase values in 12-year old boys were significantly higher in the urban area than in the rural area. A total of 4000 examinations of male public-school children showed that the red blood of the children was poorer in Oberhausen. The district of Osterfelde in Oberhausen which has extremely high air pollution has also a high rate of poor blood and a lower phosphatase value among the children. The Oberhausen children (age 10, 11 and 14 years) were smaller and lighter than the rural district children; bronchitis was 1.5 times higher; eye diseases and inflammations were 4 times as common. Skin irritation, however, was more common among rural children. The bronchitis rate among adults in Oberhausen was 10% higher in Oberhausen; eye diseases among adults were twice as high in Oberhausen as compared to the rural area.

1663 APTIC NUMBER 17565

Fenn, Wallace O.

INTERACTIONS OF OXYGEN AND INERT GASES IN DROSOPHILA. Resp. Physiol. (Amsterdam), 3(2):117-129, Oct. 1967. 16 refs.

The effect of oxygen tension on nitrogen narcosis was tested in Drosophila with oxygen tensions varying from 0.03 to 8 atm and with various pressures of a number of inert and anesthetic gases. The narcotic potency of nitrogen (34 atm), argon (24 atm), xenon (1.7 atm), nitrous oxide (1.7 atm), and carbon dioxide (0.2 atm) increased markedly when the oxygen pressure was raised from 0.21 to 1.0 or more atm. The flies survived about a week in one atm of oxygen alone, but collapsed in a few hours in the presence of both one atm of oxygen and inert gases. No such synergism between oxygen and inert gases were evident with helium at similar pressures. Alcohol and ether gave somewhat similar results; they shortened the survival times at all tensions of oxygen, the optimum partial pressure of oxygen for survival being displaced to values higher than in normal air. The possibility that the O_2-N_2 interaction found in fruit flies might be applicable to man is discussed and a tentative explanation offered for the synergism reported. The phenomena probably represents more than a mere addition of narcosis and oxygen poisoning. Since the narcotic gases reduce the survival times of oxygen tension to some extent at all concentrations of O_2, it is evident that oxygen and inert gases do not act independently on one another, but interact directly or indirectly on the same mechanism. (Author abstract modified)

1664 APTIC NUMBER 18107

Frank, Robert N., Robert E. Yoder, J. D. Brain, and Eiji Yokoyama
SO_2 (^{35}S LABELED) ABSORPTION BY THE NOSE AND MOUTH UNDER CONDITIONS OF VARYING CONCENTRATION AND FLOW. Arch. Environ. Health, 18(3):315-322, March 1969. 9 refs.

Sulfur dioxide ^{35}S ($^{35}SO_2$) was administered to the surgically isolated upper airways of anesthetized dogs via a mask with separate connections to the nose and mouth. The $^{35}SO_2$ that passed through the upper airways was monitored continuously; nearly complete removal could be measured to within several hundredths of a percent. Nasal uptake of the incoming gas (1 to 50 ppm) exceeded 99% at a flow of 3.5 L/min and fell only several percent when flow was increased tenfold (1, 10 ppm). Uptake by the mouth averaged more than 95% at a flow of 3.5 L/min (1, 10 ppm) but fell to under 50% when flow was increased tenfold. Following penetration of the mouth or nose by $^{35}SO_2$, desorption of the gas from the mucosa could be demonstrated more than 25 min after the end of exposure. (Author's Abstract)

1665 APTIC NUMBER 12301

Giguz, T. L.
EFFECT OF LOW CONCENTRATIONS OF AMMONIA AND NITROGEN OXIDES ON ADOLESCENTS UNDERGOING VOCATIONAL TRAINING IN THE CHEMICAL INDUSTRY. (Vliyanie malykh kontsentratsii ammiaka i okislov azota na podrostkov pri proizvodstvennom obuchenii ikh na predpriyatiyakh khimicheskoi promyshlennosti). Hyg. Sanit., 33(7-9):431-434, July-Sept. 1968. 3 refs.

Continuous observations made over a 2-year period on the health of 140 adolescents in a chemical industry training program are reported. The exposure of these adolescents to low concentrations of ammonia and nitrogen oxides caused definite changes in the metabolism of fat and proteins, even with 3-hr working shifts, and caused a higher incidence of diseases of the upper respiratory tract and skin. The contact of adolescents with ammonia and nitrogen oxides should be limited by the maximum possible reduction of the concentration of these substances in the air of working premises and by a reduction in the adolescents' stay in the factory. In addition, the possible raising of the age for admittance of adolescents to chemical vocational schools should be considered. (Author conclusions modified)

1666 APTIC NUMBER 18105

Goldsmith, John R.
SYNTHESIS, PERSPECTIVE, AND FUTURE APPLICATIONS. Arch. Environ. Health, 18(4):710-714, April 1969.

The proceedings of the Ninth Air Pollution Medical Research Conference are summarized and evaluated. Brief discussions are given to the following phases: areas of relevance of the findings reported; clinical importance of the meeting; and scientific findings. The background of the conference and the prospects for continued participation in this interchange are discussed. The conference was held in Denver, Colorado on July 22-24, 1968.

1667 APTIC NUMBER 18106

Gregory, Kenton L., Victoria F. Malinoski, and Charles R. Sharp
CLEVELAND CLINIC FIRE SURVIVORSHIP STUDY, 1929-1965. Arch. Environ. Health, 18(4):508-515, April 1969. 7 refs.

A study of the survivors of the 1929 Cleveland Clinic fire was made to determine long term effects of exposure to oxides of nitrogen. The mortality experience of the exposed survivors, who were in the clinic or were rescue workers at the scene, was compared to that of comparable nonexposed groups. The study did not detect any significant differences in either cause of death or long-term survival rates.

1668 APTIC NUMBER 11373

Grigor'eva, N. V.
ATMOSPHERIC AIR POLLUTION WITH MALEIC ANHYDRIDE: ITS HYGIENIC EVALUATION. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 16:26-34, 1966. 13 refs. (B. S. Levine, ed.)
CFSTI: PB 179141

Determinations of the maximum single allowable concentration of maleic anhydride were made on the principles of odor perception and mucous membrane irritation, and the threshold reflex effect on the functional state of the brain cortex. The maleic odor perception threshold, as established by 753 determinations on 12 subjects, was 1.3 mg/cu m in the most sensitive persons. The sensory irritability threshold of the substance was 1 mg/cu m.

As determined by 78 tests with three subjects, 0.85 mg/cu m represents the concentration of subthreshold reflex activity on the brain cortex. In a series of related experiments, the effects of chronic inhalation of maleic anhydride were studied by exposing four groups of 10 rats each to 0.03, 0.08, and 0.34 mg/cu m concentrations of the anhydride or its vapor for 70 days. Rats exposed to 0.08 mg/cu m exhibited a decrease in the erythrocyte count, a decrease in the activity of neutrophiles, an increase in the number of leukocytes, and symptoms of pulmonary inflammation. The 0.34 mg/cu m concentration was still active but of lesser intensity. The 0.08 mg/cu m concentration represents the threshold of toxic maleic anhydride for warm-blood animals and 0.03 mg/cu m, the subthreshold toxic dose. It is recommended that 0.5 mg/cu m and 0.05 mg/cu m be adopted as the single allowable atmospheric and maximum allowable 24-hr concentration, respectively.

1669 APTIC NUMBER 18102

Henry, Mary C., Richard Ehrlich, and William H. Blair
EFFECT OF NITROGEN DIOXIDE ON RESISTANCE OF SQUIRREL MONKEYS TO KLEBSIELLA PNEUMONIAE INFECTION. Arch. Environ. Health, 18(4): 580-587. April 1969. 9 refs.

Nitrogen dioxide penetrates into the lower respiratory tract due to its relatively low solubility. This study defines the effects of 10 to 50 ppm NO2, K pneumoniae infection, and the combination of the two stresses in squirrel monkeys. Single two-hour exposures to 10, 15, 35, and 50 ppm of NO2 affected the pulmonary function in squirrel monkeys. Although single acute exposures to NO2 did not produce deaths, a combined stress of 50 ppm NO2 and K pneumoniae challenge produced mortality. Further, squirrel monkeys exposed to 10 ppm NO2 and challenged with K pneumoniae had bacteria present 19 to 51 days after challenge while those exposed only to K pneumoniae had no residual bacteria present after the same period. Exposure to NO2 may permit better colonization of bacteria in the lungs of monkeys by inhibition of the mechanism of bacterial clearance from lungs and thus increased mortality may result.

1670 APTIC NUMBER 18120

Holma, Bo and Per-Ake Hellstroem
A CIGARETTE SMOKE DOSAGE APPARATUS FOR EXPERIMENTAL ANIMALS. Arch. Environ. Health, 18(3):386-389, March 1969. 2 refs.

A cigarette-smoke dosage apparatus for controlled smoke dosages is constructed particularly for rodents. This apparatus can be adapted to their oral cavity, in which a minimizing of the distance between the cigarette and the oral cavity is obtained. The construction and characteristics of the apparatus is presented. The apparatus can be used in studies concerning the effect on lung clearance of cigarette smoke with or without simultaneous exposure to different air pollutants. (Author's Abstract)

1671 APTIC NUMBER 11376

Imasheva, N. B.
THRESHOLD ACETOPHENONE CONCENTRATIONS DETERMINED BY ACUTE AND CHRONIC EXPERIMENTAL INHALATION. U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, vol. 16:58-68, 1966. 29 refs. (B. S. Levine, ed.)
CFSTI: PB 179141

In experiments involving low concentrations of acetophenone, 18 subjects (18-60 years of age) were studied for odor perception thresholds; 3, for threshold concentrations affecting eye sensitivity to light; and 5, (18-35 years of age), for threshold concentrations affecting electrical brain activity. In related experiments, two groups of 45 rats were continuously exposed to 0.007 and 2-0.07 mg/cu m of vapors for 70 days and checked for the following physiological indices: general behavior, weight, dynamics, muscle antagonists chronaxy ratio, etc. The concentration representing the threshold of acetophenone odor perception and its reflex effect on eye sensitivity was found to be 0.01 mg/cu m; the concentration representing the threshold of the reflex effect on electrocortical brain activity.
0.0007 mg/cu m. The rats exposed to 0.07 mg/cu m exhibited disturbed antagonists chronaxy ratios, depressed cholinesterase activity, and pathomorphological changes in internal organs. In contrast, the 0.007 mg/cu m elicited no detectable morphological shifts. From the data obtained it is recommended that the 24-hr maximum allowable acetophenone concentration be set at 0.003 mg/cu m.

1672 APTIC NUMBER 18096

Ipsen, Johannes, Francis E. Ingenito, and Margaret Deane
EPISODIC MORBIDITY AND MORTALITY IN RELATION TO AIR POLLUTION. Arch. Environ. Health, 18(4):458-461, April 1969.

Epidemiologic studies examine both unusual events and the general behavior of the disease processes that may occur in epidemic proportion. Air pollution and climatic abnormalities have been implicated in major sporadic disasters as well as more or less periodically occurring peaks of severity of disease, incidence, or mortality. Four different types of episodes are defined: "Double phenomenon," in which a causal connection between abnormal atmospheric pollution and excess morbidity and mortality appears obvious; "specific epidemiology," where an outbreak of a specific disease or intoxication can be traced retrospectively to an air pollution episode with a defined chemical or biological substance; the "unique air phenomenon," where health effects are analyzed for the same population at suitable periods before, during, and after an unusual atmospheric event; and "association by correlation in time" which is a statistical study of air measurements and medical data observed continuously over a sufficiently long period of daily records. Some of the variables to be considered in choice of statistical models are discussed.

1673 APTIC NUMBER 18104

Ipsen, Johannes, Margaret Deane, and Francis E. Ingenito
RELATIONSHIPS OF ACUTE RESPIRATORY DISEASE TO ATMOSPHERIC POLLUTION AND METEOROLOGICAL CONDITIONS. Arch. Environ. Health, 18(4):462-472, April 1969.

Two studies of the relationships between industrial absenteeism from upper respiratory infections and air pollution and meteorological data are summarized. The first study relates to weekly averages, the second to daily measurements. Variations in morbidity and air pollution were studied within a single area, metropolitan Philadelphia, in which continuous air pollution measurements and weather data were available and where records of specified absenteeism existed for a significantly large and uniformly observed industrial population. The statistical methods used to analyze the data are outlined. The results of the study are presented in tabular and graphic form.

1674 APTIC NUMBER 11936

Kapalin, V.
THE EFFECT OF CERTAIN EXTERNAL ENVIRONMENTAL CONDITIONS ON THE ORGANISM OF SCHOOL CHILDREN. (Odraz vlivu nekterych zevnich podminek na organismu deti skolniho veku). Cesk. Hyg. (Prague), 11(8):468-472, 1966. 10 refs. Translated from Czech. by Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 9p.

In the fall of 1965, three groups of Slovak children were examined for the effects of environmental conditions on body height, structure, and hemoglobin levels. The first group had spent the summer in a recreational area; the second lived in an area highly polluted by arsenic emissions from a power plant; and the third group lived in a less polluted area and had spent the summer at scout camps. Measurements in the spring of the year had indicated the maximum mean height of children from the unpolluted area agreed with the overall Slovak average. Though lower growth levels for the children from the polluted area were not statistically significant, no child in the second group was classified as very tall. Marked differences were established in hemoglobin values and warning differences in red blood cell values. In the fall, there was substantially narrower scatter of the relative heights of children who had spent the summer in the scout camps and recreational area. Extremes of body structure within each group had disappeared and differences in hemoglobin levels were less marked, indicating the leveling effect of proper diets and purer air. The children from the polluted area continued to exhibit not only decreased hemoglobin values but decreased red blood cell counts.

1675 APTIC NUMBER 12298

Khachaturyan, M. Kh., M. I. Gusev, and O. E. Gorlova
THE EFFECT OF WEAK OLFACTORY STIMULI ON THE LATENT PERIOD OF THE MOTOR REACTION OF LIGHT IN MAN. (Vliiyanie slabykh obonyatel'nykh razdrazhitelei na skrytoe vremya dvigatel'noi reaktsii cheloveka na svet). Hyg. Sanit., 33(7-9):274-276, July-Sept. 1968. 6 refs.

The latent period of motor reaction to light under weak olfactory stimuli was investigated as an index to central nervous system function which might be used to determine permissible levels of toxic substances in air. The test method, performed with an electromechanical chronoreflexometer, is described. The results of testing on three subjects with propyl alcohol in concentrations of 1.66, 1.25, and 0.9 mg/cu m varied considerably with each individual, although the most pronounced changes in the latent period of reaction were caused by the 1.25 concentration. Statistical analysis of the experimental data confirmed the significance of the observed changes. It is concluded that the latent period of reaction is a fairly sensitive index for studying the effect of olfactory stimuli and may thus be used as one method for determining one-time maximum permissible concentrations of atmospheric toxic substances. The results are also taken as evidence that low-intensity olfactory stimuli increase the lability of the central nervous system.

1676 APTIC NUMBER 11941

Kononova, V. A. and V. B. Aksenova
ATMOSPHERIC AIR POLLUTION DISCHARGES FROM SYNTHETIC ALCOHOL PLANT AND THEIR EFFECT ON MORBIDITY, SANITARY AND LIVING CONDITIONS OF THE POPULATION. Gigiena i Sanit., no. 9:3-7, 1961. 5 refs. Translated from Russian. 7p.

Investigations were undertaken to determine the extent of the area affected by the discharges from a synthetic alcohol plant and the effect of these discharges on the morbidity rate and sanitary and living conditions of the population. The area was found to be polluted by hydrocarbons, hydrogen sulfide, and sulfuric gas in a radius up to 3 km and by unsaturated hydrocarbons up to 500 meters. In a survey of the local population, many complaints were associated with the wastes emitted by the plant (headaches, dizziness, loss of appetite, etc.). The complaints were most numerous close to the plant. During a three-year period, the incidence of respiratory diseases in children in the plant area exceeded the morbidity rate of children in a control area. It is concluded that children's institutions and residential settlements should be located at least 3 km from the plant. (Author conclusions modified)

1677 APTIC NUMBER 17737

Lacassagne, Antoine, Nguyen P. Buu-Hoi, Francois Zajdela, and Germain Saint-Ruf
THE CARCINOGENIC POTENTIAL OF TWO SEVEN-RING AROMATIC HYDROCARBONS. (Sur le pouvoir cancerogene de deux hydrocarbures aromatiques a sept cycles). Text in French. C. R. Acad. Sci. Paris, Ser D, vol.266:301-304, Jan. 15, 1968. 13 refs.

Research on the carcinogenic activity of 19 aromatic hydrocarbons in mice shows that there are two carcinogenic 7-ring compounds:

peropyrene and benzo(a)naptho(1,2-c-d-e)naphthacene. The compounds were injected subcutaneously in amounts of 0.6 mg three times at intervals of a month. Diagnosis of tumors was confirmed histologically.

1678 APTIC NUMBER 17804

Lebeau, Rene
A DISCOURSE ON NITROUS OXIDE. (Propos sur le protoxyde d'azote). Text in French. Union Med. Canada, vol. 96:211-212, Jan.-June 1967. 7 refs.

Six references are reviewed on the effect of nitrous oxide on test animals or human subjects with respect to the toxicity of N2O, used as an anesthetic. The current medical opinion affirms that N2O, obtained in a state of purity of 99.5%, provides a good analgesia and a satisfactory narcosis and, in the absence of hypoxia, does not exert any action which is deletorious with respect to the principle organs. Some research indicates that N2O has no adverse effect and that any damage that occurs during its use as an anesthetic must be ascribed to re-operative hypoxia. However, other research indicates an adverse effect of prolonged inhalation of mixtures of N2O and O2 on human patients and on test animals. Nitrous oxide, it is concluded, has no adverse effect on the physiology and the anatomy of the operand when used in accordance with the anesthetic practice of the present day in surgical clinics, since the duration of the narcosis rarely exceeds 12 hours. In fact, even if the inhalation of N2O were extended to a 48-hour period, the organism of the patient would remain unharmed.

1679 APTIC NUMBER 12243

Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex., Fission Product Inhalation Program
LIPID COMPOSITION FOR SURFACTANT AND LUNG CELLS OF BEAGLE DOGS. In: Annual Report of the Fission Product Inhalation Program Sept. 1967 Through Sept. 1968. AEC Contract AT(29-2)-1013, p. 196-201, Nov. 1968. 10 refs.

Pulmonary alveoli are lined with a film of surface-active material and a layer of epithelial cells. The surfactant, a lipoprotein moiety, and cells may be washed from dog lungs with isotonic saline without any apparent physiologic damage to the animal. Thirty endobronchial lung lavages were performed on 18 normal Beagles, and the pulmonary surfactant and cells were analyzed for lipid content. The neutral lipids present in greatest amounts in both fractions were sterol esters and free cholesterol, with lesser amounts of triglycerides and free fatty acids. Cell total lipid had a higher percentage (20%) of neutral lipid than surfactant (14%). Surfactant lipid was rich in phospholipid (77% of the total lipid), especially diacylglycerylphosphorylcholin (lecithin, 74% of total lipid-P), which is thought to be the surface-active agent. Lysolecithin, sphingomyeline, phosphatidylinositol, phosphatidylserine, and phosphatidylethanolamine were present in lesser amounts. An unidentified component comprised 10% of the surfactant phospholipid-P. The phospholipid composition of the cells and surfactant was similar, but the surfactant contained a higher percentage of phospholipid than the cells. Alkyl and alk-1-enyl ethers of glycerol were quantitated in both fractions. (Author abstract modified)

1680 APTIC NUMBER 12244

Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex., Fission Product Inhalation Program
PULMONARY LAVAGE - A TECHNIQUE FOR USE IN DOGS AND ITS CLINICAL EFFECTS. In: Annual Report of the Fission Product Inhalation Program Sept. 1967 Through Sept. 1968. AEC Contract AT (29-2)-1013, p. 191-195, Nov. 1968. 3 refs.
CPSTI: LF-39

Most procedures for lavaging the lungs of dogs involve a tracheotomy to facilitate catheter placement. A technique is described that permits samples of lung surfactant and cells to be collected without the use of inhalation anesthetics or surgery and without physical damage to the lungs. For segmental lung lavaging, a Metras catheter is inserted behind the epiglottis and down the trachea. Because of a permanent bend near the tip of the catheter, litter difficulty is encountered in directing the catheter into either the left or right diaphragmatic lobe. When maximal insertion is reached, the cuff is inflated to isolate the lobe from the remainder of the lung. For alternate lavaging of both lungs, a Carlsen double lumen catheter is used. This catheter has two balloons for inflation: the one below the carina in the main bronchus separates the two lungs; the other is above the carina and separates the opposite lung from the outside atmosphere. The catheter is introduced through the mouth, directed between the vocal chords, and eased down the trachea to the carina. The balloons are then inflated and an open airway to each lung is verified by placing two extension tubes from the catheter against a mirror and observing for fogging on expiration. Based on a lack of significant clinical or histologic alterations in dogs lavaged by this technique, it is suggested that the procedure to evaluated as a means of treating individuals who have inhaled insoluble radionuclides or other noxious agents.

1681 APTIC NUMBER 18117

Lucis, Ojars J., Mary E. Lynk, and Ruta Lucis
TURNOVER OF CADMIUM 109 IN RATS. Arch. Environ. Health, 18(3):307-310, March 1969. 14 refs.

Distribution of subcutaneously injected cadmium 109 (109Cd) was studied in mature rats over a period of 14 days. The isotope was primarily deposited in the kidneys, liver, and pancreas. Within four hours after injection, cadmium appeared in the wall and in the contents of the small intestine. In the colon and in its contents, the concentration of the isotope increased gradually over a period of 24 hr. Cd content in the intestinal tract decreased progressively between 30 and 336 hr after injection.

The stomach wall concentrated and retained 109Cd, and only traces of the isotope appeared in the contents of the stomach. From the blood plasma, Cd disappeared rapidly, whereas the blood cells showed an increase in Cd concentration between 24 and 336 hr after injection. (Author's Abstract)

1682 APTIC NUMBER 12111

Mountain, John T. and Fulton R. Stockell, Jr.
A NEW APPRAISAL OF FACTORS IN AIR POLLUTION INJURY. EXPERIMENTS AND COMMENTS ON FACTORS AND MECHANISMS INVOLVED IN TOLERANCE AND SUSCEPTIBILITY TO LUNG INJURY BY OZONE AND NITROGEN DIOXIDE. Preprint, Public Health Service, Cincinnati, Ohio, Div. of Air Pollution and California State Dept. of Public Health, San Francisco, 33p., 1961. 46 refs. (Presented at Research Conference on Motor Vehicle Exhaust Emissions and their Effects, Los Angeles, Calif., Dec. 6, 1961.)

Animal experiments were performed to study the effects on biochemical changes in lungs and blood of chronic intermittent exposures to ozone and oxidant gas. Lung and serum alkaline phosphatase activity were useful indicators of injury and repair processes. Decrease in lung alkaline phosphatase accompanied injury by ozone or nitrogen dioxide, while elevation of the lung and serum phosphatase took place when tissue repair was predominant over injury. Chronic exposure to 03 affected adrenal metabolism, causing changes in gland weight and succinic dehydrogenase activity similar to those observed to follow other types of stress. Tolerance to injury by 03 or NO2 is usually associated with maintenance of near normal alkaline phosphatase activity in the lung, whereas the tolerance toward ozone observed in oil mist-treated mice is associated with maintenance of lung glutathione content and succinic dehydrogenase activity. Reduction of glutathione content and succinic dehydrogenase activity occurred in the lungs of mice exposed to 03. The physical, biochemical, or physiologic factors, which can enhance susceptibility or tolerance toward air-borne oxidants are compared on the basis of some of their known effects on tissue glutathione levels. A consistent pattern of protection against oxidant injury is associated with conditions or treatments which tend to elevate or maintain intracellular sulfhydryl moieties, particularly glutathione. The converse appears to be exemplified in that conditions bringing about reduction of cellular sulfhydryl or glutathione tend to promote susceptibility to injury by oxidants. The possibility that genetic factors may be among these adverse conditions is discussed. (Author summary modified)

1683 APTIC NUMBER 16793

Mueller, Peter K. and Margaret Hitchcock
AIR QUALITY CRITERIA--TOXICOLOGICAL APPRAISAL FOR OXIDANTS, NITROGEN OXIDES, AND HYDROCARBONS. J. Air Pollution Control Assoc., 19(9):670-678, Sept. 1969. 59 refs.

The ultimate aim of toxicological studies is to determine the effects of pollutants on the health and welfare of human beings. To get this it is essential to conduct animal studies to evaluate the potential toxicity of different pollutants. Toxicological appraisal of the photochemical oxidant type of air pollution shows: (1) The effects are primarily on the lungs and the senses. (2) There is impairment of pulmonary function in humans at concentrations found in polluted air. (3) Both ozone and nitrogen dioxide tend to oxidize the lung tissue in animals for a time. This process creates agents which have the potential for crosslinking structural proteins, and this process initiates inflammation which accelerates cell turnover rates. Both crosslinking and cell turnover rates are factors in aging, which may thus be accelerated by years of repeated exposure to oxidants. (4) Long-term exposure to low levels of nitrogen dioxide can produce pre-emphasematous lesions in the lungs of rats and mice. Studies with other species are needed. (5) Ozone, nitrogen dioxide, and dilute irradiated car exhausts increase susceptibility to respiratory infection. The constant search for more sophisticated and sensitive techniques to detect subtle changes indicative of predisease conditions should not be relaxed. Such techniques will provide chronic disease predictors of great relevance as air quality criteria. A discussion by Ralph C. Wands follows the article. (Author's Abstract)

1684 APTIC NUMBER 12241

Myers, D. S.
ESTIMATION OF INHALED PARTICLE SIZE OF 239PU02 BASED ON THE NEW LUNG MODEL AND BIOASSAY RESULTS. In: Hazards Control Progress Report No. 32(September-December 1968) and Index to Hazards Control Progress Reports Nos. 30 Through 32. California Univ., Livermore, Lawrence Radiation Lab., p. 17-20, 1969.
CFSTI: TID-4500

In a new lung model, particle deposition and elimination are considered functions of aerodynamic diameter and chemical form of the particle and of the breathing rate of the individual. Based on theoretical considerations of the model, it is possible to estimate the aerodynamic particle size of inhaled Pu(239)02. For example, if the theoretical daily elimination of a given quantity of inhaled Pu(239)02 is plotted as a function of time for three different particle sizes (0.5, 2, and 5 micron), the effect of particle size on elimination is apparent. The initial clearance of 5-micron particles of 0.86Q, where Q is the total amount of inhaled Pu(239)02. In comparison, the initial clearance for a 0.5 micron particle is only 0.26Q. The initial clearance is defined as the cumulative fecal elimination through the 2nd day after exposure and includes essentially all the Pu(239)02 cleared from the nasopharynx and tracheobronchial regions. Theoretically, the ratio of initial gastrointestinal tract clearance and the clearance (2 weeks after exposure) appears to be a function of the aerodynamic size of the inhaled particle. The estimation technique has not yet been tested experimentally.

1685 APTIC NUMBER 17795

Neukomm, S.
THE NEWT TEST IN RELATION TO INVESTIGATION ON CARCINOGENIC AND COCARCINOGENIC SUBSTANCES. Nat. Cancer Inst. Monograph, no.

9:71-73, 1962. 8 refs. (Presented at the Symposium on the Analysis of Carcinogenic Air Pollutants, Cincinnati, Ohio, Aug. 29-31, 1961.)

Subcutaneous injection of newts with highly diluted oily solutions of substances suspected to be carcinogenic or cocarcinogenic gives results within a few days. Substances giving positive results with newt tests are also positive in tests with mice, which require a longer incubation period. Thus, the rapid newt tests can be used for screening, and the intensity of the reaction gives quantitative information about the substance. Among the substances already tested are benzo(a)pyrene, dibenzo(a,i)pyrene, benz(a)anthracene, 1H-benzo(a)cyclopent(h)anthracene, 9H-benzo(e)cyclopent(i)anthracene, dibenzanthracene, and methylcholanthrene.

1686 APTIC NUMBER 11955

Oshima, Hidehiko, Masayuki Imai, Noriko Fujita, Hisako Fukuda, and Katsumi Yoshida
AIR POLLUTION AND MORBIDITY IN THE YOKKAICHI AREA. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 1(1):36-45, 1966. 18 refs. Translated from Japanese. 33p.

Between 1961 and 1962 and 1963 and 1964, the dust fall and the atmospheric sulfur dioxide concentrations were measured at 13 stations in the Yokkaichi area. The dust fall was determined by means of sedimentation; the SO2 concentration, by the PbO2 method. Equivalence lines were drawn each year from the annual averages. The monthly National Health Insurance records were used to study the effect of these pollutants on humans of all age groups. Calculation of the correlation coefficients revealed a definite correlation between such diseases as bronchitis, eye diseases, and laryngopharyngitis in the infant age group as well as bronchial asthma in the age group above 50. The correlation was particularly high between laryngopharyngitis among infants from age 0-4 as well as bronchial asthma among adults or more than 50 years of age. The diseases were correlated with SO2 rather than with the dust fall. Bronchial asthma increased from the middle of 1961 to the present in the polluted area, which coincides with an increase of the SO2 concentration; no such pronounced increase was observed in the non-polluted area.

1687 APTIC NUMBER 12499

Pratt, Charles D.
ENCLOSED EXHAUST FUMES. Preprint, Society of Automotive Engineers, Inc., New York, 4p., 1967. 18 refs. (Presented at the Society of Automotive Engineers, Texas Section Meeting, Sept. 22, 1967, Paper 680234.)

Air pollution caused by toxic fumes from the internal combustion engine is a concern to public health. Exhaust emissions are divided into four groups: carbon monoxide, nitrogen oxides, hydrocarbons, and aerosols. The acute effects of CO render it of primary concern when dealing with internal combustion engine exhaust. Carbon monoxide can cause anemia, anoxia, amnesia, confusion, poor color discrimination, and possible psychosis. Acute CO conditions exist in industrial plants. Especially dangerous situations can rise from poor ventilation in areas designed for maintaining high or low temperatures. Storage facilities for automobiles, if not properly ventilated, can be very dangerous. Early symptoms of chronic CO poisoning include lassitude, weakness, reduction of general muscle tones, loss of libido, mask-like facial expressions, and a monotone voice. Chronic exposures to CO produce deficiencies in blood forming organs, circulatory system, and the blood. Heart muscle dilations, anemia, low blood pressure, and predisposition to hemorrhages are resultant clinical evidence of chronic CO poisoning. Hydrocarbons, especially polycyclic aromatics, are implicated in cancer formation. Examination of the effects of oxides of nitrogen and aerosols show that they are extremely dangerous. Nitrogen oxides are very toxic to lung tissue. The particulate emissions from the gasoline powered vehicle can cause problems due to their size and chemical properties.

1688 APTIC NUMBER 18137

Ramsey, James M.
THE TIME COURSE OF HEMATOLOGICAL RESPONSE TO EXPERIMENTAL EXPOSURES OF CARBON MONOXIDE. Arch. Environ. Health, 18(3):323-329, March 1969. 19 refs.

Eight nonsmoking university students were exposed weekly for varied times to varied concentrations of carbon monoxide (CO). Three nonsmoking students were unexposed. Hemoglobin and hematocrit values were obtained from all subjects before, immediately after, 48 hr after, and seven days after each exposure, with weekly and monthly examinations continuing for nearly three months after exposures ceased. Results indicate that hematological response to intermittent CO varies individually, yet hemoglobin and hematocrit means for the eight exposed subjects show an immediate postexposure increase that is significant. This elevation subsides in 48 hr but does not return to pre-exposure levels. In exposed subjects there is also a gradual, less reversible increase in hemoglobin and hematocrit that may continue for two to three weeks after exposures have ceased and for two months maintains levels significantly higher than original values. (Author's Abstract)

1689 APTIC NUMBER 11957

Rapoport, I. A.
MUTAGENIC EFFECT OF INDUSTRIAL TOXINS AND OTHER TOXIC SUBSTANCES. (Mutagennyi effekt promyshlennykh iadov i drugikh toksicheskikh veshchestv). Inst. Leningrad (USSR), Toxicology Labs., Proc. Symp. Problems Gen. Ind. Toxicol., Leningrad, 1964. 4 refs. (Jan. 23-25.) Translated from Russian. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services. 14p.

Aspects of the relationship between toxicology and the study of enzyme-gene interactions are discussed. A knowledge of these relationships in terms of chemical modifications and differentiation among mutations is necessary for an understanding of any possible correlation between hereditary mutability and toxicological rules. Regardless of the fact that many toxic substances possess mutagenic properties and, in turn, some newly found mutation-active products are toxic, there are differences in the nature of action between both classes of substances. A strikingly high correlation links molecular mutation stimuli with allergens; this joint mutation basis is capable of revealing the etiology of a number of diseases and leads to measures for preventive hygiene. Research in the USSR has revealed the genetic characteristics of several hundred products from industrial and laboratory syntheses, and very strong mutagens have become known. Among triple heterocycles widely used industrially, real mutagens include diazomethane, ethylenimine, and ethylene oxide; diethyl sulfate, dimethyl sulfate, and some other sulfur containing esters of acids show a much higher mutation yield in the gas phase than in solution. A question of toxicological interest is the determination of the mutation activity of such biochemical semiproducts as alpha ketonic acids which, though usually considered harmless, have been shown experimentally to have some mutagenic effects.

1690 APTIC NUMBER 17718

Boms, W. and D. Henschler
ABSENCE OF A CARCINOGENIC EFFECT OF NITROUS GASES ON THE GOLD HAMSTER. (Fehlen einer cancerogenen Wirkung von nitrosen Gasen beim Goldhamster). Text in German. Experientia, vol.15: p. 55, Jan. 1968. 3 refs.

Long-term intermittent exposure of mice to 40 ppm nitrogen dioxide produced no malignant tumors. To confirm this result, 40 gold hamsters were exposed to 40 ppm NO2 and 20 ppm NO for 16 months. None of them died during this period. A total of 36 hamsters were available for the histological evaluation. Again, no malignant tumors were found in the lungs or in other organs.

1691 APTIC NUMBER 17417

Safronov, V. A.
CLINICAL ASPECTS AND TREATMENT OF TOXIC PNEUMONIA CAUSED BY EFFECTS OF NITROGEN OXIDES. (Klinika i lecheniye toksicheskikh pnevmoniy, vyzyvayemykh vozdeystviyem okislov azota). Text in Russian. Voenno-Med. Zh. no. 2:28-34, Feb. 1967. 8 refs.

Symptoms of pneumonia brought on by nitrogen oxide poisoning are described in detail. Two case histories are reported. Distinctions between toxic pneumonia and toxic bronchitis are stressed. Both first-aid and long-term treatment to combat poisoning, hypoxia, infection, and bronchospasm are discussed.

1692 APTIC NUMBER 12193

Sasamoto, Hiroshi and Tetsuro Yokoyama
EFFECTS OF AIR POLLUTION ON JAPANESE CIVILIAN POPULATION (FINAL REPORT). Keio Univ., Tokyo (Japan), Dept. of Internal Medicine, Contract DA-92-557-FEC-39575, Proj. 3A025601A827, Task 00 065FE, R-J-252-2, 95p., Aug. 19, 1968. 51 refs.
CFSTI, DDC: AD 676847

Methods to detect the pulmonary function impairment due to airborne pulmonary diseases were investigated. Studies were also conducted on the routine pulmonary functions in the Japanese civilian population; clinical observations in the air-polluted area of Tokyo and Yokohama are described. The pulmonary function studies included assessment of the spirometry and the mechanics of breathing; baseline studies on the routine pulmonary function tests; some fundamental observations of the airway resistance; the AaD and of CO pulmonary diffusing capacity in cases of the normal healthy as well as chronic pulmonary diseased people; and the effects of bronchodilators and cigarette smoking on the ventilatory capacity and alveolar gas exchange. The %VC and FEV1 were found to be the best combination for routine diagnostic parameters on the ventilatory functions. The baseline study on the ventilatory functions allowed the establishment of regression equations for the mathematical mean on the various parameters. The impaired alveolar gas exchange which was probably due to airway obstruction in persons with bronchitis was demonstrated. The carbon monoxide pulmonary diffusing capacity may routinely be used to detect impaired overall alveolar gas exchange. The physiological significance of the arterial alveolar nitrogen tension difference was emphasized. Year-round clinical observations on the civilian population revealed a high incidence of bronchitis during the winter. Bronchitic patients did not complain of similar signs and symptoms found in patients with Tokyo-Yokohama asthma. Cigarette smoking could not be correlated with bronchitic patients.

1693 APTIC NUMBER 17470

Shirakawa, Kenichi
SYMPTOMS OF NERVE TROUBLE DUE TO PUBLIC NUISANCE. HEAVY METALS AND ORGANIC SOLVENTS. (Kogai niyoru shinkeishojo. Jukinzoku to yukiyozai). Text in Japanese. Nippon Rinsho (Japan Clin.), 28(3):551-555, March 10, 1970. 10 refs.

Characteristic symptoms of heavy metal and organic solvent poisoning are discussed, with emphasis on representative neural symptoms. Motor symptoms identified with inorganic lead poisoning are paralysis of the arms, mononeuritis, and polyneuritis, the latter characterized by sharp contractions of the legs and arms. Early symptoms of alkyl lead poisoning are chronic fatigue, headache, and vertigo. These are followed by muscular ache, low fever, perspiration, low blood pressure, feeble pulse, and declining mental faculties, which are defined as nerve debility at the serious stage. Arsenic poisoning manifests itself in catarrh of the digestive and respiratory organs and in neuritis and skin disease. In arsenic poisoning, perceptive nerve troubles appear after one or two weeks' exposure, followed by mental derangement and, in some cases, pain, resulting in the loss of sensation of movement. Barium poisoning is considered a cause of alopecia and polyneuritis. Acute cases exhibit fever, skin disease, alimentary and mental disorders, in addition to respiratory diseases. The latter can result in death. Chronic inorganic mercury poisoning is accompanied by vertigo, insomnia, and heart acceleration. Organic mercury poisoning exhibits diverse symptoms, including concentric constriction of the visual field. Immediately following ingestion, manganese produces hallucination and mental disorders. Chronic manganese poisoning manifests in symptoms resembling those of Parkinson and Wilson's disease. Tin poisoning does not appear to remarkably influence neural organs, though alimentary disorders can result from prolonged exposure. Symptoms of cadmium poisoning, in addition to those of organic solvents, are briefly reviewed.

1694 APTIC NUMBER 12324

Sjostrand, Torgny
THE FORMATION OF CARBON MONOXIDE IN THE LIVING ORGANISM. A FACTOR TO BE CONSIDERED IN SPACE FLIGHT. Preprint, World Health Organization, Geneva, Switzerland, WHO/AP/66.25, 6p., 1965 (?). 9 refs.

Since the air expired by humans always contains endogenously produced carbon monoxide, the CO concentration in the atmosphere of a closed breathing system will rise and theoretically may reach toxic levels. When a hemoglobin molecule breaks down, a molecule of CO is liberated for every porphyrin ring that is opened, i.e., four molecules of CO per molecule of hemoglobin. Thus, endogenous CO formation may be expected to increase whenever hemoglobin breakdown increases, for example during physical exercise. The relative activity level of such a breakdown can be ascertained by determining the carboxyhemoglobin (COHb) concentration of the blood, provided that exposure to external CO is excluded and pulmonary ventilation is normal. Methods of determining low COHb concentrations are described; these can be based either on using a CO meter with blood samples or by having the subject rebreathe in a closed system with absorption of carbon dioxide. It appears that about 12-15 ml CO are formed in the body per 24 hours; this excludes the still unresolved possibility of CO oxidation within the organism. Measures must be provided to eliminate the CO from the space cabin atmosphere.

1695 APTIC NUMBER 17427

Sklyarevsky, L. Ya.
INDUSTRIAL SECURININE POISONING. (Otravleniye sekurininom v proizvodstvennykh usloviyakh). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, 10(57):57, 1966.

Twenty persons fell ill as the result of occupational exposure to securinine nitrate dust in the air. Symptoms occurred in the 1st to 7th day of exposure and included severe inflammation on exposed skin, especially the upper eyelids, headache, ringing in the ears, dizziness, nausea, weakness, aching joints, and involuntary bending backward of the head and torso. Recovery took from 2 to 14 days. Bending of the head and torso is indicative of overstimulation of the neutral reflex apparatus of the spine. Control measures taken at the plant prevented further incidences of sickness.

1696 APTIC NUMBER 16837

Speizer, Frank E.
AN EPIDEMIOLOGICAL APPRAISAL OF THE EFFECTS OF AMBIENT AIR ON HEALTH: PARTICULATES AND OXIDES OF SULFUR. J. Air Pollution Control Assoc., 19(9):647-656, Sept. 1969. 45 refs.

This review evaluates the present state of our knowledge of the effect on human health of environmental exposure to oxides of sulfur, sulfates, and particulate matter. The measurements of these pollutants in ambient air are the net results from all sources of pollution in combination with factors influenced by weather and meteorological considerations and cannot therefore incriminate single source, or a single pollutant. Direct effects from acute, high ambient air pollution disasters have been adequately demonstrated. Specific working groups exposed to unusually high levels of these pollutants do not demonstrate dramatic effects. However, the association between the prevalence of chronic respiratory disease in the general population and specific levels of these air pollutants have been demonstrated. The major thrusts of epidemiological investigations have been to study the effects of chronic exposure to ambient levels of smoke and sulfur dioxide. The studies to date have collected and analyzed point-prevalence data and information obtained from retrospective investigations. Although epidemiological investigations cannot prove a cause-and-effect relationship, the consistency of the results is such that one must conclude that a causal association is likely. A discussion by I. J. Selikoff is presented in the appendix. (Author's Abstract Modified)

1697 APTIC NUMBER 18071

Sprague, Homer A. and Ruth Hagstrom
THE NASHVILLE AIR POLLUTION STUDY: MORTALITY MULTIPLE REGRESSION. Arch. Environ. Health, 18(4):503-507, April 1969. 9 refs.

Multiple regression methods have been employed, utilizing linear and curvilinear methods, to analyze infant and fetal death rates from 1955 to 1960 in Nashville, Tenn. The independent variables were four air pollution indices and socioeconomic class. The dependent variable was the sex-adjusted death rate by census tract analyzed separately by race. In all instances addition of a second variable did not significantly improve the fit resulting from first entering the most correlated variable. For white postneonatal infant mortality, sulfation and SO3 provided significant regressions. Dustfall alone or as an interaction variable appeared with greatest frequency as the most related variable. The aim of separating socioeconomic from air pollution factors was not realized. However, there was sufficient indication of an association between levels of air pollution and certain categories of infant and fetal mortality to justify further investigation. (Author's Summary)

1698 APTIC NUMBER 18074

Sterling, Theodor D., Seymour V. Pollack, and J. Weinkam
MEASURING THE EFFECT OF AIR POLLUTION ON URBAN MORBIDITY. Arch. Environ. Health, 18(4):485-494, April 1969. 7 refs.

Data consisting of hospitalization records for 1961 among Blue Cross member groups in the Los Angeles area were subjected to multivariate, nonlinear analyses. Results are given for a category "relevant diseases" that summarizes pollution effects on allergic disorders, inflammatory diseases of the eye, upper respiratory infection, influenza, bronchitis, diseases of the heart, rheumatic fever and muscular diseases, and other diseases of the respiratory system. The pollutants used in the study were oxidant, CO, SO2, NO2, NO, NOx, O3, oxidant precursor, and particulate matter. Temperature and humidity were also measured. A parallel series of air pollution and hospital records were available for a consecutive series of 223 days (March 17 through October 26, 1961). The detailed description of all the data and of overall results are given. The results of the study indicate a strong effect of air pollution on the health of individuals in a community as measured by the frequency and length of hospitalization.

1699 APTIC NUMBER 17778

Stresemann, Ernst
THE MEDICAL AND BIOLOGICAL IMPORTANCE OF EXHAUST GASES FROM MOTOR VEHICLES. Staub (English translation from German of: Staub, Reinhaltung Luft), 29(6):11-16, June 1969. 58 refs.

Automobile exhaust gases affect more and more the hygienic conditions in Europe. The acute and chronic biological effects of these emissions are discussed on the basis of investigations carried out in laboratory or by medical and epidemiological methods. The effects of the individual components of automobile exhaust gases are presented (carbon monoxide, carcinogens, aldehydes, lead, nitrogen oxides, and oxygenated compounds), and the basically different nature of acute and chronic effects is discussed in detail. Conclusions with respect to preventive hygiene follow from the final consideration. (Author summary modified)

1700 APTIC NUMBER 18101

Suhs, Richard H., James L. Lumeng, and Mark H. Lepper
AN EXPERIMENTAL IMMUNOLOGIC PERPETUATION OF CHRONIC BRONCHITIS. Arch. Environ. Health, 18(4):564-573, April 1969. 16 refs.

The development of an animal experimental model by which the numerous implicated etiologic conditions of human chronic bronchitis can be effectively studied as to the relative role each may play individually, or as variable combinations in producing this disease is of prime importance. This report presents the initial model using rabbits for the experimental production of the histologic chronic bronchitis having as the basis of the pathogenesis, immunological mechanisms utilizing both time relationships and controls with quantitation of results as a reference. This report covers only the methodology, skin testing, and the histologic evaluation of the lungs and tracheobronchial tree. (Author's Abstract)

1701 APTIC NUMBER 17244

Suzuki, Takeo
STATUS OF AIR POLLUTION BY AUTOMOBILE EXHAUST IN JAPAN -- IN VIEW OF PUBLIC HEALTH. (Jidosha haikigasu niyoru kankyoosen no taiyo -- Koshu eiseigaku no tachiba kara). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(11): 702-712, Nov. 15, 1968. 17 refs.

In the past, research on the effect of motor vehicle exhaust gas on humans was limited to laboratory experiments. When the effect of emissions on public health becomes more visible, a comparative study was undertaken in the United States of carbon monoxide density inside a house and outdoors. No significant difference was observed, indicating that buildings do not work to exclude atmospheric pollutants. Of motor vehicle exhaust components, those that matter from hygienic viewpoint are, in order of their importance carbon monoxide, nitric oxide, and lead. Carbon monoxide density is commonly referred to in determining the effect of auto exhaust has on the human body because of its strong chemical affinity with hemoglobin; and a medical survey has disclosed a relationship between the amount of blood and CO density in environmental atmosphere. People living in areas of heavy traffic have an average CO hemoglobin of 3.75%, which is nearly equivalent to that found in cigarette smokers. Of the nitrogen oxides, NO alone may not have a specific effect on the human body, but even low concentrations of NO2 effect the respiratory organ even with low density because of its water-resistant nature and the ease with which it pentrates the lung cells. Unlike the other gaseous components, lead accumulates also in water, vegetation, and foods.

1702 APTIC NUMBER 17571

Takagi, Sadayuki F.
NEUROPHYSIOLOGICAL STUDIES ON THE OLFACTORY RECEPTIVE MECHANISM. (FINAL REPORT). Gunma Univ. (Japan), Dept. of Physiology, Contract DA-CRD-AFE-S92-544-68-G110, Proj. 9777, Task 01 004FE, Rept. J-271, 14p., April 1969. 21 refs.
CFSTI, DDC: AD 693275

The olfactory receptive mechanism was investigated by (1) recording the olfactory impulses produced by various odors in the exposed olfactory epithelia of frogs; (2) determining the electropositive potentials of 122 odors applied to frog olfactory epithelia and olfactory eminentia; (3) establishing an olfactory conditioned reflex in dogs; (4) determining the effects of the sectioning of the lateral olfactory tract, anterior limb of the anterior commissure, and trigeminal nerve on olfactory-conditioned behavior in rats; and (5) performing electro-physical studies on the activities of the pyriform lobe and amygdala in dogs. The olfactory impulses elicited by derivatives of butyl alcohol and ethyl ethers and by camphoraceous and peppermint odors were used to compare the similarity or dissimilarity of odors. Partial results are presented in charts and diagrams. The experiment suggests that the discriminative mechanism varies from odor to odor. Sixteen of 122 odors were found to elicit electropositive potentials in both excised and degenerated olfactory epithelia.

although their shape was different, electropositive potentials in the olfactory eminentia do not appear to differ fundamentally from those recorded in the olfactory epithelia. By means of the olfactory conditioned reflex in dogs, it was confirmed that the olfactory threshold of a dog to clover oil (1 times 10 to the minus 7th power mg/cc) is a million times lower than that of the human. The other experiments are still in progress.

1703 APTIC NUMBER 17466

Takemoto, Kazuo
DUST AND PULMONARY CARCINOMA. (Funjin to haigan). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 7(5):23-32, Jan. 1, 1970. 34 refs.

The relationship between lung cancer and both air pollution and cigarette smoking has been intensively studied. However, comparative studies on the incidence of lung cancer in males and females; in Europeans, Japanese, and Americans; in smokers and nonsmokers; and on the incidence of lung cancer and stomach cancer do not appear to establish a straight forward relationship. For example, animal tests that indicated a correlation between smoking and lung cancer also disclosed a higher incidence of cancer in male animals than in female. The study is discussed in terms of the function of sex hormones and evidence suggesting that the generation rate of lung cancer varies according to sex, races, and country and is influenced by congenital factors. It may be obvious that tar and nicotine contained in cigarettes are carcinogenic, but it is more evident that the carcinogen-carrying dust particles are below 0.1 micron and can not be seen, even through an optical microscopic examination. Among air pollutants, SO2 and NO (NO2), which strongly effect airway membranes and cause bronchoconstriction of airway resistance, present different types of reactions when accompanied by dust particles. Empirical findings on the relationship between dust and lung cancer show that carcinogen-containing dusts are asbestos, nickel, chrome, and radio active dust, all associated with occupational diseases. As determined by animal tests, dust serves as a carrier of atmospheric carcinogens.

1704 APTIC NUMBER 18103

Thurlbeck, W. M., I. Horowitz, J. Siemiatycki, M. S. Dunnill, J. C. Maisel, P. Pratt, and R. Ryder
INTRA- AND INTER-OBSERVER VARIATIONS IN THE ASSESSMENT OF EMPHYSEMA. Arch. Environ. Health, 18(4):646-659, April 1969. 5 refs.

Sixty paper-mounted whole-lung sections were examined twice by five observers using each of four methods. Intra- and inter-observer variations were assessed. One method was inferior to the others. This method assessed five grades of severity of emphysema in each of ten zones and attempted to increase the sensitivity of measurement of emphysema. No one of the three other methods was clearly superior. The quickest method matched lungs against 11 standard grading pictures. This method had the largest within-reader error but this may be overcome by developing better standards. A ten zonal analysis using three grades of emphysema in each zone and the stratified random-point count method had about the same total variance. The former method had a smaller within-reader variance but a greater between-observer variation. (Author's Summary)

1705 APTIC NUMBER 12290

Tkachev, P. G. and A. A. Gladkovskaya
ON METHODS OF STUDYING THE EFFECT OF AIR POLLUTANTS ON THE POPULATION. (K voprosy o metodakh izucheniya vliyaniya atmosfernykh zagryaznenii na naselenie). Hyg. Sanit., 33(7-9):106-108, July-Sept. 1968. 7 refs.

Olfactory thresholds were investigated in 530 school children living in the vicinity of a factory producing aliphatic amines; the main group comprised those residing within 300-1500 m, and the control group within 12-15 km. The Elsberg-Levy method was used to determine the stimulability of the olfactory analysor; in addition, olfactory acuity was tested with a mixture of diethylamine and triethylamine in equal parts. The children in the main group showed a higher olfactory threshold towards the amine mixture and a weaker reaction to its irritant effect. Thre was a distinct relationship between the olfactory threshold for amines and the length of residence in the district affected by the factory emissions: the deterioration in the sensitivity of the olfactory analysor occurred after 1-1/2 to 2 years' residence near the factory. The children's olfactory sensitivity to other substances (thymol, camphor, and tar) was not affected. The use of the specific agent (the mixture of amines) as well as the usual stimuli improved the sensitivity of olfactometry as a method for the early detection of unfavorable effects of air pollutants. (Author conclusions modified)

1706 APTIC NUMBER 11953

Toyama, T., H. Kahyo, J. Kagawa, S. Yagura, S. Adachi, N. Yamamoto, F. Iriyama, F. Kumagai, S. Osawa, K. Nakamura, and T. Nakamura
STUDY ON THE PREVALENCE OF RESPIRATORY SYMPTOMS IN A RURAL AREA (KASHIMA, IBARAGI PREF.) OF JAPAN. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 1(1):24-35, 1966. 14 refs. Translated from Japanese. 53p.

A survey on respiratory diseases (asthma, bronchitis, common cold, cough) was conducted in Kashima, a rural area in Japan. A revised questionnaire of the British Medical Research Council was used for the survey which was conducted along with simple pulmonary ventilatory function tests on 678 randomly selected adults of both sexes 40 to 65 years of age. The atmospheric sulfur dioxide concentration, the aerosol concentration, wind direction, and wind velocity were simultaneously measured. The SO2 concentration was below 0.01 ppm, the weight density of the suspended particulates ranged from 500 micrograms/cu m (maximum) to 13 micrograms/cu m (minimum); the average was 90 micrograms/cu m. The response rate to the interview survey was high: 91.6% for males; 95.5% for females; and 93.8% for the total. Prevalences of respiratory symptoms were computed for each question; relationships to sex, age, and the amount of smoking were determined. The survey results were also compared to those obtained in England, the U. S., and Canada. The prevalences in males were higher than in females; those of older persons were higher than of younger ones; and those of smokers, higher than those of nonsmokers. International comparison revealed that the prevalences in the Kashima area were considerably lower than those in the agricultural areas of England, the U. S., and Canada. The pulmonary function tests revealed a slightly higher forced expiratory volume than that of mail-truck drivers in London.

1707 APTIC NUMBER 18076

Ury, Hans K. and Alfred C. Hexter
RELATING PHOTOCHEMICAL POLLUTION TO HUMAN PHYSIOLOGICAL REACTIONS UNDER CONTROLLED CONDITIONS. Arch. Environ. Health, 18(4): 473-480, April 1969. 15 refs.

The ideal study of the health effects of air pollution would consist of the replication of naturally-occurring pollutant levels to which selected and sensitive populations are exposed. Then each population could be observed during equal time periods for each level of each pollutant under otherwise identical conditions. A filtered air study was analyzed by statistical procedures. In this investigation 15 subjects, most of these with relatively severe pulmonary emphysema, lived about three weeks in a room which had a controllable air supply. Observations were made of lung function, some other physiological measurements, and three pollutants (oxidant, NO, and NO2). The statistical procedures for investigating the relationship between lung function and air quality for this study are discussed in detail.

1708 APTIC NUMBER 18099

Verma, Mahadeo P., Fred J. Schilling, and William H. Becker
EPIDEMIOLOGICAL STUDY OF ILLNESS ABSENCES IN RELATION TO AIR POLLUTION. Arch. Environ. Health, 18(4):536-543, April 1969. 8 refs.

A retrospective epidemiological study was undertaken for a three year period (1965-1967) to investigate the relationship of air pollution and absences from work due to illness. Medically documented absenteeism records were available for a study population that consisted of males and females between 16 and 64, a multiracial group of white collar workers of an insurance company located in metropolitan New York. Meteorological data for each day of the study period were obtained from the U. S. Weather Bureau in New York City. A strong time dependence and yearly cyclical behavior tended to influence all of the data. After removing time trends, no strong positive relationship between respiratory absences and pollution variables studied were noted.

1709 APTIC NUMBER 18134

Wagner, W. W., Jr., L. P. Latham, P. D. Brinkman, and G. F. Filley
PULMONARY GAS TRANSPORT TIME: LARYNX TO ALVEOLUS. Science, 163(3872):1210-1211, March 14, 1969. 8 refs.

The transport time of gas from the larynx to pulmonary alveolar capillary blood was directly measured by injecting a bolus of carbon monoxide into the inspired airstream of dogs and photoelectrically monitoring the formation of carboxyhemoglobin in the capillaries on the surface of the lung. The rapidity of transit (0.3 second) implies that gas transport during inspiration is facilitated by an interaction between bulk flow and diffusion. (Author's Abstract)

1710 APTIC NUMBER 11676

Wayne, Walborg S. and Paul F. Wehrle
OXIDANT AIR POLLUTION AND SCHOOL ABSENTEEISM. Preprint, National Air Pollution Control Administration, Durham, N. C., Div. of Health Effects Research, Southern California Univ., Los Angeles, Dept. of Pediatrics, and Los Angeles County - Southern California Univ. Medical Center, 25p., 1968 (?). 6 refs.

Absence rates attributed to respiratory illness were studied in relationship to oxidant concentrations in two elementary school populations in Los Angeles by school year, season, week, and day-of-week. The analysis revealed no evidence of statistically significant associations betweeen absence rates and oxidant levels. The pattern of absence rates for respiratory symptoms was similar at both schools. Rates were highest in the winter and usually greater on Monday and Friday than on other days of the week. In contrast, oxidant levels were lowest in the winter and usually higher in the middle of the week than on Monday and Friday. Substitution of standardized daily absence ratios for absence rates in the analysis of the day-of-week data in relationship to oxidant concentrations confirmed the basic results of the study. Presumably non-illness phenomena such as week-end trips had been removed in the ratios, thus, allowing absences actually due to illness to be studied in relationship to oxidant. (Author abstract modified)

1711 APTIC NUMBER 18100

Weiner, N. D., M. [illegible], and A. Felmeister
MONOMOLECULAR FILMS AS A MODEL TO STUDY AIR POLLUTANT-MEMBRANE INTERACTIONS. Arch. Environ. Health, 18(4):636-640, April 1969. 18 refs.

A study was made of the interaction of typical air pollutant gases with monomolecular films of biologically interesting materials. Synthetic dipalmitoyl lecithin, natural egg lecithin, E coli phospholipids, protein, and phospholipid-protein films were studied. The observed reactions of NO2 with the films suggest that the interaction of NO2 with lipids may result in cell membrane expansion and subsequent changes in cell membrane permeability or enzyme activity.

1712 APTIC NUMBER 11848

Wicken, A. J.
ENVIRONMENTAL AND PERSONAL FACTORS IN LUNG CANCER AND BRONCHITIS MORTALITY IN NORTHERN IRELAND, 1960-62. AGB Research Ltd., London (England), Health Surveys Unit, Tobacco Research Council RP-9, 84p., 1966. 5 refs.

The results of a statistical study of lung cancer and bronchitis mortality in Northern Ireland in the period 1960-1962 are presented. The findings describe the extent to which lung cancer and bronchitis mortality were associated with various environmental factors. Lung cancer mortality rates for both men and women aged 35 years in Northern Ireland were substantially below those for England and Wales, the standardized mortality ratios being 55% and 69% respectively. The lung cancer mortality rate was associated with smoking habits, area of residence, social class, occupational air pollution, morning cough three or more years before death, previous respiratory illness, and mortality from cancer and bronchitis among close relatives. The bronchitis mortality rate among men aged 35 or more was substantially below (67%) that for England, and Wales. However, the bronchitis mortality rate among women was virtually the same. The rate for both men and women was linked to smoking habits, area of residence, social class, morning cough three or more years before death, and mortality from bronchitis among close relatives. Evidence about the relationship between bronchitis mortality and occupational air pollution was inconclusive. Among male nonsmokers, the lung cancer and bronchitis mortality rates were three to four times higher in Belfast than in rural districts. The corresponding ratios for female nonsmokers were lower, especially for lung cancer. (Author summary modified)

1713 APTIC NUMBER 18098

Winkelstein, Warren, Jr., and Seymour Kantor
STOMACH CANCER. POSITIVE ASSOCIATION WITH SUSPENDED PARTICULATE AIR POLLUTION. Arch. Environ. Health, 18(4):544-547, April 1969. 11 refs.

A positive association can be shown between suspended particulate pollution and death rates from gastric cancer. Mortality rates for gastric cancer in white men and women, 50 to 69 years of age, are almost twice as high in areas of high suspended particulate air pollution as in areas of low pollution in a northeastern United States industrial area. This association appears to be independent of the effect of economic status and is not apparently attributable to the ethnic distribution of the population in the study area. (Author's Summary, Modified)

EFFECTS—PLANTS AND LIVESTOCK

1714 APTIC NUMBER 12415

Brandt, C. Stafford
EFFECTS OF AIR POLLUTION ON CROP PRODUCTION. Preprint, 11p., 1967. (Presented at the Ontario Pollution Control Conference, Toronto, Dec. 4-6, 1967.)

The contamination of vegetation by atmospheric sulfur dioxide and fluoride and by phytotoxicants associated with photochemical smogs is discussed. Identifiable plant injuries are summarized and a distinction is made between plant injury and damage. The former is considered to refer to the symptom or the respose; the latter, only to the effect of the symptom or response on the desired use of a plant. In the case of sulfur dioxide, acute injury occurs whenever the atmospheric concentration at the leaf exceeds a certain threshold value. As long as the concentration stays less than this threshold, acute injury does not occur. Chronic injury may occur in time. This type of injury is almost impossible to identify with certainty in the field. The easiest description is that of premature senescence, a phenomena that is becoming more and more common in many areas. In the case of fluoride, atmospheric concentrations are of little importance, but the amount accumulated in the tissues is important. When the concentration exceeds certain values, acute symptoms develop. There is no recognizable chronic-type injury due to fluoride. A 10 to 12% reduction of plant productivity along the eastern seaboard is predicted as the result of air pollution in general and photochemical smog in particular.

1715 APTIC NUMBER 17779

Darley, Ellis F.
USE OF PLANTS FOR AIR POLLUTION MONITORING. J. Air Pollution Control Assoc., vol. 10:198-199, June 1960. 22 refs. (Presented at the Air Pollution Control Association 52nd Annual Meeting, Los Angeles, Calif., June 22-26, 1959.)

Plants used to monitor air pollution, whether they occur naturally or are cultivated, must meet certain requirements: they must be susceptible and display symptoms characteristic of the pollutant in question; they should be growing in a suitable environment and have rather wide distribution; and plant injury from pollutants must be distinguishable from that caused by insects, frost, or heat. Where naturally suitable conditions do not prevail, susceptible species can be planted in approximate sites or grown under controlled conditions. The characteristic symptoms caused by oxidants, ozone, fluorides, sulfur dioxide, and ethylene are described. In a few cases, a plant may detect more than one toxicant simultaneously, although the symptoms cannot always be separated. Plants can monitor concentration levels of pollutants as well as kind of pollutant. Plant monitoring is particularly useful where costs are a significant factor or in areas where air pollution is not suspected and chemical monitoring is therefore not normally in effect. The occurrence and spread of oxidant plant damage in California is described as an example of the use of plants for pollution monitoring purposes.

1716 APTIC NUMBER 12330

Dochinger, L. S., W. W. Heck, F. W. Bender, and F. L. Fox
CHLOROTIC DWARF OF EASTERN WHITE PINE: AN OZONE-SULFUR DIOXIDE INTERACTION. Preprint, Public Health Service, Cincinnati, Ohio, National Air Pollution Control Administration, Agricultural Research Service, Cincinnati, Ohio, Crops Research Div., and Forest Service, Delaware, Ohio, Northeastern Forest Experiment Station, 10p., 1969. 7 refs.

The simulation of chlorotic dwarf symptoms by ozone and sulfur dioxide alone or in combination on susceptible white pine ramets was correlated with ambient air levels of the pollutants in forest plantations. In the first of two series of experiments, sensitive and resistant white pine raments were exposed to 10 pphm of sulfur dioxide, to 10 pphm of ozone, or to 10 pphm of sulfur dioxide and ozone. Chlorotic dwarf sysmtoms of flecking, occasionally accompanied by a shedding of older needles, were noted on most sensitive plants. The percent of mottling injury and the premature drop of older needles in the six exposures far exceeded the damage in a single gas exposure; this strongly suggests the presence of a synergistic action of the two pollutants on sensitive white pine. In similar experiments, plants were exposed to 6 pphm of ozone, 6 pphm of sulfur dioxode, or 6 pphm of sulfur dioxide and ozone. The most intense needle mottling and older foliage loss were evident in both the sulfur dioxide and the mixed gas exposures. It is concluded that, even though recorded levels of single gases are not high enough to damage white pines, mixtures of gases can result in foliar impairment of photosynetic needs below that required for normal tree growth.

1717 APTIC NUMBER 12331

Feder, W. A., F. L. Fox, W. W. Heck, and F. S. Campbell
VARIETAL RESPONSES OF PETUNIA TO SEVERAL AIR POLLUTANTS. Preprint, National Air Pollution Control Administration, Cincinnati, Ohio, Agricultural Section, Agricultural Research Service, Cincinnati, Ohio, Crops Research Div., and Massachusetts Univ., Waltham, 11p., 1968. 2 refs.

Fifteen varieties of petunia plants were tested for their sensitivity to urban pollutants. The plants were exposed in standard greenhouse exposure chambers to three concentrations of ozone, sulfur dioxide, peroxyacetyl nitrate (PAN), and nitrogen dioxide for one hour and to a single concentration of irradiated auto exhaust for 1.5 hours. Only six varieties were exposed to PAN. All results are tabulated, with plant injury recorded as a percentage injury to the whole plant. Comparative sensitivity of the 15 varieties to each pollutant is indicated. Among the most sensitive plants were both red and white flowering varieties. The highest comparative sensitivities were shown by the varieties White Cascade, Red Magic, and Warrior.

1718 APTIC NUMBER 17857

Hanson, George P., Linda Thorne, and Carlos D. Jativa
VITAMIN C--A NATURAL SMOG RESISTANCE MECHANISM IN PLANTS? Lasca Leaves, 1970:6-7, March 1970. 1 ref.

Varieties of the petunia plant with a higher concentration of vitamin C also have a higher smog resistance than the other varieties. The test plants were exposed to ozone, a major constituent of Los Angeles smog (0.4 ppm for 2.5 hours). Petunia leaves treated with ozone had 10% less ascorbic acid than unexposed leaves. Smaller and younger leaves contain much more of the vitamin per unit size than larger and older leaves. Leaves of 1.5-2.0 cm contain twice the vitamin C per sq cm of leaf surface as leaves of 4.0-4.5 cm. The more tolerant varieties of petunia gave a higher score than the more sensitive varieties, and the same relationship holds in comparisons of asorbic acid concentration. Contrary to popular opinion, white petunias are not more sensitive per se to smog than those of other colors, although the White Cascade variety is rather sensitive. Leaves dusted or sprayed with ascorbic acid are more tolerant to smog, but leaves developing after treatment retain the original sensitivity of the plant in question.

1719 APTIC NUMBER 16805

Hibben, C. R.
PLANT INJURY BY OXIDANT-TYPE POLLUTANTS IN THE NEW YORK CITY ATMOSPHERE. Plant Disease Reptr., 53(7):544-548, July 1969. 21 refs.

Snowstorm petunia, W3 tobacco, eastern white pine, common and hybrid lilacs, and oxidant-sensitive rubber strips were exposed to the Brooklyn atmosphere in unfiltered and carbon-filtered growth chambers. The cracked rubber strips and oxidant-type symptoms on the plants, including adaxial and bifacial flecks and abaxial glaze and discoloration, demonstrated the presence of oxidants at phytotoxic concentrations. The W3 tobacco and eastern white pine were injured the most severely. Symptoms resembling those caused by ozone on plants in the unfiltered chambers, and the inducement of identical symptoms by experimental fumigation with ozone, implicated this gas as one of the phytotoxicants. (Author's Abstract)

1720 APTIC NUMBER 12489

Ishizuka, Yoshihisa, Shogo Ochiai, Yoshio Saiki, Nobuaki Kadoya, Yoko Nishikawa, Takashi Yokoyama, Yoshihiro Hatsuoka, Harumi Koyasu, Osamu Undajawa, Hideo Ishiwata, Toshio Ohno, and Michio Maeno
EFFECTS OF AIR POLLUTANTS (2). Taiki Osen Kenkyu (J. Japan Soc. Air Pollution, 2(1):78-80, 1967. Translated from Japanese. 12p.

Studies on the relationship between air pollution and the sulfur content of tree leaves, the effect of sulfur dioxide on the germination of pear pollen grains, and the effects of pollutants on trees are summarized. The sulfur content of tree leaves, as determined by the barium sulfate gravimetric method, was positively correlated with atmospheric sulfur oxide concentrations measured by the lead dioxide method. The effects of sulfur dioxide on the germination of pollen grains were relatively minor. Correlations were observed between the degree of air pollution and the growth, sturdiness, and autumnal tints of trees. In the case of ginko and platanus trees, there was an intimate correlation between sturdiness and leaf color and the amounts of dust and SO3 on the leaves. However, the damage appeared to occur by a different mechanism in each species.

1721 APTIC NUMBER 17579

Leone, Ida A., Eileen Brennan, and Robert H. Daines
SULFUR DIOXIDE CAUSES INJURY TO FOLIAGE IN SPRING MONTHS. New Jersey A[illegible]., 1965:12;15, Sept.-Oct. 1965.

In New Brunswick, N. J., certain plant species including tulip, violet, columbine, scarlet hawthorne, petunia, verbena, field raspberries, and tomatoes exhibit foliage injury from late April through May. As determined by an analysis of meteorological data obtained in New Brunswick and Carlstadt over a three-year period, the phenomena is due to plant growth coinciding with periods of air stagnation conducive to the accumulation of sulfur dioxide at ground level.

1722 APTIC NUMBER 17447

MacDowall, F. D. H.
PREDISPOSITION OF TOBACCO TO OZONE DAMAGE. Can. J. Plant Sci. (Ottawa), 45(1):1-12, Jan. 1965. 26 refs.

Effects of ontogeny, genome, nitrogen, and water supplies and ozone itself in predisposing tobacco plants to ozone damage (including weather fleck) are described from experiments in both field and greenhouse. The fully expanded leaf became susceptible to low doses of ozone at the time its protein content started to fall. Topping slowed the development of susceptibility of leaves, with a resultant decrease in the susceptibility of the plants. Effects of genome were partly of an onotogenetic nature. Susceptibility was enhanced by both deficiency and excess of nitrogen. Moisture prior to fumigation increased susceptibility. Long-term effects of moisture supply were the same as its influence on drought-hardiness. Susceptibility was increased by a shortened photoperiod, low day temperature, and high night temperature, indicating a protective influence of photosynthate. A large or a small dose of ozone appeared to predispose against or toward, respectively, susceptibility to the next dose. Wherever tested, stomatal opening was positively associated with damage. Since stomatal opening regulates the flux of ozone to the leaf, it controls the amount of damage to tissues of a given degree of susceptibility. (Author abstract modified)

1723 APTIC NUMBER 17784

McKee, Herbert C. and Frederick W. Bieberdorf
VEGETATION SYMPTOMS AS A MEASURE OF AIR POLLUTION. J. Air Pollution Control Assoc., 10(3):222-225, June 1960. 7 refs. (Presented at the Air Pollution Control Association 52nd Annual Meeting, Los Angeles, Calif., June 21-26, 1959.)

A study was made of the use of ash and elm trees as indicators of relative pollution levels. Sulfate content of vegetation samples can be used to obtain a semi-quantitative measure of long-term exposure to sulfur dioxide. To the extent that SO2 is also related to over-all pollution levels, this can be used as general indicator of pollution. In the study made in the Houston area, these data were used to calculate pollution indexes in different areas of Harris County, in order to determine relative pollution loadings. These data provide the best means of making such comparisons, and are much better than data obtained with a mobile laboratory. Permanent sampling stations might offer a means of obtaining more accurate results if a sufficient number of stations could be operated, but for a survey in which only limited financial resources are available, this method offers the best possibility where applicable. The comparative ease and economy of obtaining data are major advantages. The results represent the cumulative effects of continuous exposure over a known period of time, with a continuity which can only be approached with continuous recording equipment subject to interruptions by breakdown, power failure, etc. The major disadvantage is the fact that cumulative results give no indication of short time peak values that occur during the sampling period. (Author conclusions modified)

1724 APTIC NUMBER 17514

Menser, H. A. and G. H. Hodges
EFFECTS OF AIR POLLUTANTS ON BURLEY TOBACCO CULTIVARS. Agron. J., vol. 62:265-269, March-April 1970. 13 refs.

Nine burley tobacco (Nicotiana tabacum L.) varieties were tested for susceptibility to air pollutants in fumigation chambers and field experiments. Ozone concentrations of 20.0 and 30.0 pphm administered for 1.0 and 1.5 hours, respectively, caused significantly more leaf injury than 10.0 pphm ozone administered over a three-hour period. This trend was apparent, even when total ozone dosages were about equal. At the lowest rate, ozone caused the most injury to Burley 2 and Ky 16, and the least injury to Burley 49 and Ky 9. Cultivars exhibited much smaller differences in degree of leaf injury when ozone was given at relatively high concentrations. Burley 2 and Ky 9 continued to be susceptible and tolerant, respectively, at the high rates. The response of the nine varieties to low concentration mixtures of ozone and sulfur dioxide revealed that the two gases act synergistically to cause injury. In the chamber experiments, low concentrations of ozone produced fleck-like markings on upper leaf surfaces. Ozone and sulfure dioxide mixtures induced upper surface markings that were similar to but larger than the ozone lesions. Field symptoms of weather fleck consisted of characteristi ozone flecking on Burley 2, Burley 11B, Ky 9, Ky 12, and Ky 16 and bifacial necrotic lesions on Burley 37, Burley 49, and Ky 35. The varieties that showed the greatest tolerance were Burley 49 and Ky 12. In the course of the field experiments, phytotoxic ozone levels (5.0 pphm) were recorded on 20 days and 12.0 pphm on one day. (Author abstract modified)

1725 APTIC NUMBER 17749

Middleton, J. T., L. O. Emik, and O. E. Taylor
AIR QUALITY CRITERIA AND STANDARDS FOR AGRICULTURE. J. Air Pollution Control Assoc., 15(10):476-480, Oct. 1965. 36 refs.

Many food, fiber, forage, and forest crops and a number of animals are adversely affected by a variety of air pollutants. The effects of ethylene, fluorides, ozone, peroxyacyl nitrates, and sulfur oxides are discussed. Their effects upon animals and plants can best be judged by criteria which describe the reaction of biologic materials to pollutant concentration and exposure time. Four criteria are recognized: interference with enzyme systems; change in cellular chemical constituents and physical structure; retardation of growth and reduction in production from altered metabolism; and acute immediate tissue degeneration. Information on tissue degenerative effects due to these pollutants is the most common. There are some reports on growth and productivity reduction, but little data are available on cellular alterations and interference with enzymes which are essential to the ultimate definition and prediction of the significance of the effects of pollutants on growth and productivity of agriculture. Dosage data are available which indicate the degenerative effects of some specific pollutants on certain tissues of hosts. Political-social judgements are made because of the knowledge of the effects of these specific pollutants. This knowledge permits the establishment of standards which define air quality necessary for the protection of agriculture. The setting of standards for a single pollutant effects upon crops and animals effectively serves as a precedent and indicates the necessity of establishing air quality values for pollutant mixtures emitted into and produced within the air resource at different geographic locations as the polluted air moves throughout the typically multigovernment jurisdictions of the airsheds. (Author abstract modified)

1726 APTIC NUMBER 12195

Mukammal, E. I., C. S. Brandt, R. Neuwirth, D. H. Pack, and W. C. Swinbank
AIR POLLUTANTS, METEOROLOGY, AND PLANT INJURY. World Meteorological Organization, Geneva, Switzerland, Commission for Agricultural Meteorology, WMO-TN 96, WMO-No. 234.TP.127, 73p., 1968. 177 refs.

The problem of air pollution injury to agriculture and the present state of knowledge is reviewed in order to assist meteorologists and others concerned in seeking means of preventing or controlling the extent of injury. The source of various contaminants and their chemical reactions in a contaminated atmosphere are examined in detail. The variations in the susceptibility of plants to air pollution damage as related to meteorological and other factors in the plant environment are described. These factors, many of which exert their influence through their effect of stomatal movement, include light, nutrition, exposure, relative humidity, and temperature. The recognizable symptoms of air pollution injury are discussed and suggested for indentifying the causative agent and recognizing similar symptoms produced by other disorders are given. A section on air pollution meteorology states that knowledge of the atmosphere's ability to transport and dilute contaminants cannot be applied to air pollution problems without concurrent consideration of pollutant emissions and the biological sensitivity and response characteristics of certain plants. The effects of surface configuration on diffusion, to vertical and horizontal turbulent diffusion, atmospheric transport, research problems, and meteorological applications to air pollution problems are discussed. Present and possible future programs in the prediction of pollutant concentration, air pollution potential, and pollution damage are reviewed; the general principles involved in collecting and analyzing air samples to determine the nature and concentrations of pollutants are outlined. Control measures and the present situation are also discussed. (Author summary modified)

1727 APTIC NUMBER 17751

Noble, W. M.
PATTERN OF DAMAGE PRODUCED ON VEGETATION BY SMOG. Agr. Food Chem., 3(4):330-332, April 1955. 15 refs. (Presented at the American Chemical Society, Divisions of Analytical, Industrial and Engineering, and Water, Sewage, and Sanitation Chemistry, Symposium on Air Pollution, 126th Meeting, New York, 1954.)

A new method of diagnosing smog injury, based on the sensitivity of certain aged cells has been added to previously known macroscopic and microscopic methods of diagnosing vegetation damage. Macroscopic observation shows that silvering, glazing, streaking, or speckling occurs on leaves of plants. The formation of anthocyanin is also observed. Microscopic observation shows that the cells become enlarged and usually turgid. This phase is followed by plasmolysis. The new method is a type of banding which occurs in the same location on leaves on the same age. The location appears to be related to cell maturity. A distinct pattern of banding was observed in some form on all but one of 50 species studied, following a single exposure to smog. The area damaged was that in which cellular differentiation had most recently occurred. Fumigations with gasoline mixed with ozone and with car exhaust fumes mixed with ozone produced these bands. Familiarity with this pattern makes it possible to determine by visual inspection whether damage was caused by smog or some other agent. It also assists in establishing that gasoline vapors and car exhaust gases are potential sources of crop damage. Because the location of the injury seems to depend on the stage of development of the leaf cells, plant fumigation could be of use to the botanist for studying growth and development rates of plants. (Author abstract modified)

1728 APTIC NUMBER 18112

Otto, Harry W. and Robert H. Daines
PLANT INJURY BY AIR POLLUTANTS: INFLUENCE OF HUMIDITY ON STOMATAL APERTURES AND PLANT RESPONSE TO OZONE. Science, 163(3872): 1209-1210, March 14, 1969. 7 refs.

Ozone injury to Bel W3 tobacco and pinto bean plants increases with increasing humidity. The degree of plant injury sustained correlates well with porometer measurements; this indicates that the size of stomatal apertures increases with increasing humidity. Humidity may therefore influence plant response to all pollutants and may account in part for the greater sensitivity of plants to ozone-type injury in the eastern United States compared with the same species of plants grown in the Southwest. (Author's Abstract)

1729 APTIC NUMBER 17446

Rich, Saul and Gordon S. Taylor
ANTIOZONANTS TO PROTECT PLANTS FROM OZONE DAMAGE. Science, vol. 132:150-151, July 15, 1960. 6 refs.

During a period when a variety of plants showed severe damage attributed to ozone, tomato plants sprayed with the fungicide manganous 1,2-naphthoquinone-2-oxime exhibited less injury than other tomato plants in the same plot. The antiozonant action of the fungicide and 8-quinolinolates was determined experimentally, together with that of diphenyl-p-phenylenediamine and other compounds used as antiozonants in the rubber industry. The materials were applied to the type of cloth used to make field tents for shade-grown tobacco. Tomato plants protected by cloth treated with cobaltous 8-quinolinolate showed practically no injury after being exposed to 0.8 ppm ozone for 4 1/2 hrs. Compounds used in the rubber industry proved even more effective as antiozonants, particularly dialkyl-p-phenylenediamine and nickel di-N-butyldithiocarbamate. These materials may afford a useful way to reduce weather fleck of tobacco and other plant injuries caused by excessive atmospheric ozone.

1730 APTIC NUMBER 16818

Santamour, Frank S., Jr.
AIR POLLUTION STUDIES ON PLATANUS AND AMERICAN ELM SEEDLINGS. Plant Disease Reptr., 53(6):482-484, June 1969.

Growth in height of various species and seedlots of Platanus in ambient greenhouse air averaged only 75 percent of that in a carbon-filtered atmosphere. Variation in growth response among and within seedlots indicated that selection for pollution-tolerant individuals is feasible. Variation in susceptibility to leaf injury was exhibited by plants fumigated with ozone and sulfur dioxide. American elm seedlings were more tolerant of both fumigants than Platanus, and differences in tolerance among progenies were apparent. (Author's Abstract)

1731 APTIC NUMBER 12291

Shcherbak, N. P.
EFFECT OF DISCHARGES FROM OIL PROCESSING PLANTS ON POLLUTION OF SOIL AND VEGETATION BY 3,4-BENZPYRENE. (Vliyanie vybrosov predpriyatii po pererabotke nefteproduktov na zagryaznennost' pochvy i rastitel'nosti 3,4-benzpirenom). Hyg. Sanit., 33(7-9):109-112, July-Sept. 1968. 1 ref.

Soil and vegetation samples collected in the vicinity of a Moscow factory which processes kerosene distillate to various organic solvents were analyzed for 3,4-benzpyrene (BP) content; the plant was known to be a heavy emitter of BP to the atmosphere. The pattern of soil pollution and findings in vegetation are described. Heavy BP pollution occurred in an area of several dozen square kilometers around the factory. After discharge into the air, the BP is deposited on soil and plants and finds its way to open bodies of water; its high stability in the external environment causes a gradual accumulation in soil. Washing BP-contaminated plants in hot running water for 30 min did not completely remove the pollutant; the BP washed away may be of atmospheric origin, while the portion which cannot be washed off comes from the soil.

1732 APTIC NUMBER 17453

Smola, J., J. Matousek, R. Barcal, and J. Srutek
EVALUATION OF BIOCLIMATE IN PLZEN BY THE LICHEN OCCURRENCE.
(Hodnoceni bioklimatu mesta Plzne pomoci vyskytu lisejniku).
Text in Czech. Cesk. Hyg. (Prague), 12(3):167-169, 1967. 5 refs.

The results of a bioclimatological investigation in Pilsen by a lichen occurrence method were correlated with dust sedimentation data. The results showed that lichen is a sensitive indicator of air pollution and provides more valuable information than ambulant bioclimatological methods. The lichen occurrence method is also simple and easy to use. (Author summary modified)

1733 APTIC NUMBER 17449

Spierings, F.
INFLUENCE OF AIR POLLUTION ON CROP PLANTS IN SOME INDUSTRIAL AREAS IN THE NETHERLANDS. (Invloed van luchtverontreiniging op land- en tuinbouwgewassen in de nabijheid van enkele industriecentra in Nederland). Text in Dutch. Inst. of Phytopathological Research, Wageningen (Nederlands), Rept. 217, 58p., 1957 (?). 8 refs.

Prompted by serious damage to plant bulbs caused by air pollution in an area northwest of Amsterdam, the Institute of Phytopathological Research conducted a study in that area and two other relatively large areas: west of Rotterdam and east of Sluiskil (Zeeland, near the Belgian border). A field investigation was first made, using specially controlled flower beds of gladiolus and alfalfa, which are particularly sensitive to hydrogen fluoride and sulfur dioxide, respectively, these two industrial gases being considered the most dangerous to plant growth. Distribution of the intensity of damage on the experimental plots indicated the direction taken by the noxious gases, their manner of propagation, and the extent of damage caused. Damaged leaves were then analyzed chemically for fluorine or sulfur content. Commercial crops were compared with those experimentally grown, and crops from areas known to be free of pollution were compared with those from the affected areas. Plants were also 'fumigated' at the Wageningeu laboratory, under simulated practical conditions. Comparisons were made of varieties of the two kinds of plants that were known to be either sensitive or insensitive to the industrial gases. The freesia plant, which suffered extensive damage in Dutch greenhouses during autum 1956, was also tested in the gas chambers. Two varieties of tulips were tested: Blue Parrot, which is sensitive to gases, and Preludium, which is not. Other plants tested were barley, broad beans, kidney beans, corn, lettuce, buckwheat, sugar beets, tomatoes, loosestrife, and knotgrass.

1734 APTIC NUMBER 17755

Taylor, O. C.
AIR POLLUTION WITH RELATION TO AGRONOMIC CROPS: IV. PLANT GROWTH SUPPRESSED BY EXPOSURE TO AIR-BORNE OXIDANTS (SMOG). Agron. J., vol. 50:556-558, 1958. 9 refs.

The effects of smog on citrus were determined. Plants treated with synthetic smog included Lisbon lemon scion on Troyer citrange stock, clonal Lisbon lemon cuttings, and Marsh grapefruit seedlings. A group of clonal Lisbon lemon cuttings and Marsh grapefruit seedlings were also exposed to natural smog. Bean, petunia, and tomato plants, known to be susceptible to smog injury were used as indicators in each experiment. The oxidant concentrations were about 0.15 ppm which approximated that found in the air around Los Angeles. Synthetic smog significantly reduced the growth of rooted Lisbon lemon cuttings, Lisbon lemon scion on Troyer citrange stock, and grapefruit seedlings without visible symptoms of leaf injury. Growth suppression by natural Los Angeles smog was less pronounced, probably because of smog-free periods during the experiment which allowed partial recovery. Synthetic and natural smog suppressed blooming of petunia plants and fruit set by tomato plants, as well as reducing growth rate by approximately 50%. Leaves of tomato, bean, and petunia were visibily injured by the two types of smog. The young fully expanded leaves were highly susceptibe to injury. Premature leaf sensescence and drop of older lemon leaves was caused by extended exposure to synthetic and natural smog. The rate of water use by lemon cuttings and lemon scions was reduced 25% by the synthetic smog.

EFFECTS—MATERIALS

1735 APTIC NUMBER 17775

Binger, W. W., R. H. Wagner, and R. H. Brown
RESISTANCE OF ALUMINUM ALLOYS TO CHEMICALLY CONTAMINATED ATMOSPHERES. Corrosion, 9(12):440-447, 1953. 15 refs. (Presented at the Ninth Annual Conference, National Association of Corrosion Engineers, Chicago, Ill., March 16-20, 1953.)

Of the many factors connected with atmospheric corrosion problems in chemical plants, refineries, and other industries, those encountered most often are combinations of hydrogen sulfide, carbon dioxide, sulfur dioxide, hydrogen chloride, moisture and dirt. In general, it has been found that aluminum alloys are resistant to atmospheres containing these contaminants. In addition, the problem in most plants is further aggravated by the formation of dust and/or fumes. An active laboratory as well as field testing program is continuing to demonstrate that aluminum alloys of the type used for architectural applications are very resistant to corrosion by a wide variety of organic and inorganic chemicals. The use of aluminum-base alloys in the coke, soda, ash, sulfur, power, paper, salt, petroleum and petrol-chemical industries has reduced corrosion losses with resultant savings in maintenance costs. Some of the applications where aluminum alloys have proved successful are tank roofs, siding, roofing, windows, duct work, ladders, handrail, instrument tubing, and tread plate. It is believed that through cooperative field testing it will be possible to demonstrate many additional applications in those and other industries where aluminum alloys can be used to advantage. A sound, practical installation can best be obtained by taking advantage of all the information and experience that is readily available. (Author abstract modified)

1736 APTIC NUMBER 17458

Manolache, Mircea, Dumitru Raileanu, Mihai Teodorescu, and Olga Mitoseriu
STUDY OF THE PROTECTION OF ALUMINUM OBJECTS AGAINST A CORROSIVE ENVIRONMENT BY MEANS OF MODERN PAINTS. (Studiul protectiei aluminiului cu vopsele moderne in medii agresive). Text in Romanian. Construct. Masini, 20(11):662-666, Nov. 1966. 9 refs.

Aluminum objects coated with 12 varieties of synthetic resin-base paints were exposed for 3 years to two types of corrosive atmosphere: marine and industrial. Two types of aluminum were also used: technically pure aluminum (Al 99.5) and an aluminum-magnesium alloy (AlMg 3). The resin bases used were polyurethane, acrylic copolymers, perchlorovinyl resins, epoxides, alkides, and chlorinated rubber. Experimental results indicated that a white polyurethane coating was most effective in both environments, while a yellow alkide was best for the marine atmosphere and a white epoxide, for the industrial atmosphere. The poorest results in both atmospheres were given by a perchlorovinyl; an expoxide of black tar was poorest for the marine atmosphere and a green epoxide, for the industrial.

1737 APTIC NUMBER 17535

Molinski, Stanislaw
CORROSION PROBLEMS CONNECTED WITH THE INDUSTRIALIZATION OF THE COUNTRY. (Zagadnienia korozyjne zwiazane z rozwojem uprzemyslowienia kraju). Text in Polish. Chemik (Gliwice), 20 (7/8):243-246, 1967. 5 refs.

Problems associated with increasing corrosion of the atmosphere, waters, and the soil are discussed. The rate of steel corrosion in the most industrialized part of Poland, in Upper Slesia, was .02-.40 mm per year. The pH of atmospheric precipitation was 5.2-6.1. The high degree of acidity is due to the high amount of sulfur dioxide in the atmosphere as a result of the combustion of coal rich in sulfur content. With the four-fold expected growth of industry within the next 20 years, the situation will increase. The preventive measures outlined to cope with this problem are discussed.

1738 APTIC NUMBER 17408

Osaka Municipal Office, Japan, Dept. of Public Nuisance Countermeasures
REPORT OF AIR POLLUTION OF OSAKA CITY IN 1968 WITH METAL CORROSION LEVEL TAKEN AS A REFERENCE INDEX. (Osakashi showa 43 nendo no kinzokufushokudo o shihyo toshita taikiosen no jittai to eikyo chosakekka). Text in Japanese. Nenryo Oyobi Nensyo (Fuel and Combustion), 36(10):966-976, Oct. 1, 1969.

Experimental findings on metal corrosion under the influence of atmospheric pollutants and under regulated conditions in a laboratory are presented. Theories on the mechanisms by which atmospheric pollutants corrode metal and the acceptability of the level of metal corrosion as an indicator of the level of air pollution were investigated in four types of tests. Variations in metal corrosion were examined with light reflection tests using a metal membrane consisting of Ag, Cu, and Ni. From the evidence that the reflection rate is higher in summer than in winter, it is inferred that metal corrosion is closely related to temperature. Variations in metal corrosion were examined with electro resistance. Tests on metal corrosion under low SO2 density were made in a laboratory whose atmosphere was controlled to contain few pollutants but SO2 and little variation in temperature. This was done to determine the correlation between SO2 corrosion and humidity and temperature. In the fourth test, rust products were collected from corroded materials by steel brash and, after granulation, examined by X-ray's. Along with rust products namely Fe2O3, Cu2O, Cr2O2, FeS2, and FeHO2, a product was found containing sulfur, though in small amounts. Great differences were noted between the level of metal corrosion due to actual atmospheric exposure and that found in the laboratory. They are apparently due to the existence of diverse pollutants including suspended particulates, in the atmosphere and to differences of humidity and temperature.

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1739 APTIC NUMBER 18135

Stephens, Edgar R., Frank R. Burleson, and Kenneth M. Holtzclaw
A DAMAGING EXPLOSION OF PEROXYACETYL NITRATE. J. Air Pollution Control Assoc., 19(4):261-264, April 1969.

A damaging explosion of the smog component peroxyacetyl nitrate (PAN) was traced to the presence of liquid PAN in a pressure gauge and pipe fitting attached to the metal container. Some of the PAN vapor had condensed while stored in a cold room at about 0 C over a weekend. Recommendations for avoiding a repetition of this accident are given. (Author's Abstract)

1740 APTIC NUMBER 12425

Trusova, V. N.
INVESTIGATIONS OF SPECIAL DESIGNS FOR BASE INSULATORS WITH VARIOUS TYPES OF CONTAMINATION. (Issedovaniia spetsial'nykh konstruktsii opornykh izoliatorov pri razlichnykh vidakh zagriaznenii). Elektr. St. (Moscow), no. 8:65-70, Aug. 1967. 2 refs. Translated from Russian. Joint Publications Research Service, Washington, D. C., 12p., Feb. 1968.
CFSTI: PB 179633

Various base insulators were compared with respect to their sensivity to rain, fog, temperature, pressure, wind, and atmospheric dust. The insulators were installed on 35 kv open distribution units of power stations subject to different contaminating conditions. Two stations were located in regions surrounded by saline soil; another was in an area heavily contaminated by alumina, soda potash, cement, and slate industries. The reliability of the insulators was estimated by the number of leakage current pulses of a given amplitude in a given period or the length of operation before flashover. Different insulator designs are required for cementing and noncementing contamination. In the case of cementing contamination, best results were obtained on insulators with a strongly increased diameter of the upper element. This factor equalizes voltage distribution and provides a protective umbrella against contamination. For noncementing contamination, drying is significant. In areas of salt contamination, good results were obtained with insulators having a semiconducting glaze.

1741 APTIC NUMBER 17475

Weber, G.
THE INFLUENCE OF SULPHUR CONTENT ON CORROSION. (Der Einfluss des Schwefelgehaltes auf das Korrosionsergebnis). Text in German. Mitt. Ver. Grosskesselbesitzer, 50(1):60-66, Feb. 1970. 6 refs.

Conductance and direct corrosion measurements were taken for two oil-fired steam boilers with capacities of 90 and 100 t/h. The first boiler was fired with a fuel oil containing 0.9% sulfur; the second boiler was fired with fuel oil containing 1.65% sulfur. For corrosion measurements, up to 100 probes cooled with compressed air were inserted into the flue gas duct ahead of the air preheater. The weight loss of each probe and the surface temperature of every tenth probe were measured. The weight loss through operational corrosion was considerable at the plant fired with the higher sulfur fuel. However, to about 100 C (or even 90 C) surface temperature, the weight loss was so low that maintenance of a wall temperature of about 100 C prevented the air preheater from premature wear. Standstill corrosion was about the same in both plants, which means that it is largely independent of the sulfur content. The weight losses were 0.38% of the initial weight/1000h of standstill for the plant fired with the lower sulfur fuel and 0.45% at the second plant.

ECONOMIC ASPECTS

1742 APTIC NUMBER 11816

Etheredge, Lynn, Dorian G. Lucey, and William Spector
COST BENEFIT ANALYSIS--PLANNED AND PROJECTED. In: Air Pollution Project: An Educational Experiment in Self-Directed Research, Summer 1968. Associated Students of the California Inst. of Tech., Pasadena, p. 255-265, 1968.

An economic model developed for a cost-benefit analysis of Los Angeles air pollution illustrates the correlation between the level of atmospheric pollutants and the damage done by the pollutants as measured in dollars, in addition to the relationship between the cost of control measures and the amount of control that can be expected from a given expenditure. Once the difficulty of obtaining an appropriate pollution index is resolved, the model should make possible policy recommendations for smog control in the Los Angeles area. Currently available data suggest that the cost of air pollution to Los Angeles residents amounts to at least $269 million annually. This figure includes only low estimates of a few of the costs from pollution; the actual figure is undoubtedly much higher. Therefore, far more research is required to develop a cost analysis that is adequate for policy decisions. Areas of research that should be given priority in future studies are a model of the photochemistry of Los Angeles smog; a model of mixing and dispersion in the Los Angeles basin; development of methods for measuring phychological costs; and determination of long-term health effects of Los Angeles air pollution.

1743 APTIC NUMBER 12319

Gerhardt, Paul H.
COSTS AND INCENTIVES FOR AIR POLLUTION CONTROL. Preprint, Air Pollution Control Association, New York City, 19p., 1969. 6 refs. (Presented at the Air Pollution Control Association Annual Meeting, 62nd, New York, June 22-26, 1969.)

The costs of air pollution, in terms of economic losses from its effects and costs of control, are briefly discussed. Implementation of the 1967 Air Quality Act could entail outlays of $1 to $2 billion by 1974 on an annualized basis, or about 0.1 to 0.2% of the projected annual GNP. A pollution control program by individual firms often can entail an impairment of its competitive position, unless all competing firms are required to meet a common standard. Two basic approaches to control are reviewed: economic incentives (tax credits, direct cost-sharing payments, emission reduction payments or credits, accelerated depreciation, and grants) and direct regulations (including emission taxes or charges and such legal penalties as fines). The advantages and drawbacks of tax credits, emission reduction payments, and emission charges are outlined, and a possible approach of combining government cost sharing with regulation is tentatively suggested. Present trends in the U. S. indicate a growing use of regulation and enforcement rather than economic incentives in the abatement of air pollution.

1744 APTIC NUMBER 12418

O'Connor, John R. and Joseph F. Citarella
AN AIR POLLUTION CONTROL COST STUDY OF THE STEAM-ELECTRIC POWER-GENERATING INDUSTRY. Preprint, Air Pollution Control Association, New York City, 25p., 1969. 8 refs. (Presented at the Air Pollution Control Association Annual Meeting 62nd, New York, June 22-26, 1969.)

The results of the National Air Pollution Control Administration's comprehensive survey of the cost of particulate control in the steam-electric power generating industry are presented. The survey, limited to gas cleaning equipment placed in service since January 1958, represents control cost information for 107 collector systems in 60 plants. The aggregate capital investment reported in particulate control equipment, as well as fly ash handling and storage equipment, was approximately $112 million. In addition, the plants spend about $4.6 million annually to operate the equipment and dispose of the collected fly ash. The data obtained reflects a trend toward the exclusive use of electrostatic precipitators, most of which have design efficiencies greater than 98%. As compared to the years 1958-1962, significant reductions in the installed cost per kilowatt of these gas cleaning units are indicated for 1963-1967. As determined by linear regression analysis, the installed cost of a precipitator for an individual boiler can vary widely, due probably to factors such as labor costs, required ductwork, and structural support. Although maintenance and operating costs of a precipitator are fairly constant for a given company, there is considerable variation in the costs between companies. Similarly, the cost fly ash disposal varies widely. Theoretical analysis of a 600 megawatt coal-burning power plant shows that the cost of pollution control is 0.35 to 1.0% of the total cost of power to the consumer, including transmission and distribution costs as well as the production costs. This means that, for the average residential electric bill of $120 for a utility with particulate control of 98% or greater, approximately $0.42 to $1.20 is related to costs of control equipment.

STANDARDS AND CRITERIA

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1745 APTIC NUMBER 17701

Aver'yanov, A. G.
AIR EVALUATION IN INDUSTRIAL PREMISES IN THE PRESENCE OF SEVERAL POLLUTANTS. In: Limits of Allowable Concentrations of Atmospheric Pollutants. V. A. Ryazanov (ed.), Book 5, Washington, D. C., U. S. Public Health Service, March 1962, p. 128-131. (Translated by B. S. Levine.) (Also: Gigiena i Sanit., no. 8:64-66, 1957.)

A method is proposed for calculating limits of allowable concentrations of pollutants in cases where vapors of several solvents, of several irritating gases, or both carbon monoxide and nitrogen are simultaneously discharged into a work area. Under such circumstances, a satisfactory condition of the air can be achieved when the sum of the individual ratios of the actually determined concentrations to their corresponding maximum allowed concentrations do not exceed unity, according to the formula a1/x2 plus a2/x2 ...... plus an/xn less than 1, where a1, a2 ...... an denote the actual concentrations of the pollutant components, and x1, x2 ...... xn denote the limits of their corresponding allowable concentrations when each pollutant is present individually.

1746 APTIC NUMBER 12118

Goder, Richard
WHAT ARE STANDARDS FOR THE INCINERATOR INDUSTRY? Preprint, 13p., June 1963. 9 refs.

The role of the incinerator industry in bearing responsibility for continuous development of incinerator design is discussed. A project is described in which three different standard incinerators, complying with the code specifications of the Incinerator Institute of America (IIA), Los Angeles County, and New York City, respectively, were tested by procedures outlined in A.S.M.E. Test Codes. Design and performance showed wide variation among the three units. There was considerable latitude in incinerator design to meet a specified performance, and it was apparent from the tests that the IIA design standards will safely meet the limitations required by most American cities to assure proper performance. Little progress in proper design of incinerators for refuse disposal can be made until a universal agreement on test standards, procedures, and instrumentation is adopted by air pollution officials and the industry.

1747 APTIC NUMBER 17521

Japan Association of Industrial Hygiene, Tokyo
RECOMMENDATIONS ON PERMISSIBLE DENSITIES, ETC. (1968). (Kyoyo nodo nado no kankoku. (1968 nen)). Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 7(5): 44-50, Jan. 1, 1970.

Permissible density, noise and temperature levels are discussed. The permissible density refers to the maximum density which has no adverse effect on the health of workers. Since recommendations are intended to prevent occupational diseases, they are not to be used for other purpose, e.g., for relative comparisons of poisonous substances, evaluations of air pollution in living quarters, or diagnoses. The permissible densities of 88 substances are tabulated. The appendix of the first part concerns dust measurements. The measuring height is from 1 to 1.5 meters, and 20 measuring points are chosen around the dust source. Dust measuring apparatus are classified into two groups. The first comprises electric dust collectors, impingers, and filters, the second contains filter paper and digital dust measuring apparatus. The permissible value of noise is shown in graphic form and has central frequency as the abscissa with exposure time as the parameter. Ten years exposure to noise below these values should not increase noise-induced permanent threshold shifts over 10 dB for the frequency below 1 kiloHerz, 15 dB at 2 kilo (Herz, and 20 dB) over 3 kiloHerz. Permissible temperature is tabulated for 70% relative humidity and 0.1 meter per second wind velocity. A 10% change of humidity is equivalent to a 1 degree change of temperature, and a 0.5 meter per second increase of wind velocity is equivalent to a 1.5 degree decrease of temperature.

1748 APTIC NUMBER 16751

Pottinger, J. F.
NEW STANDARDS FOR INCINERATORS IN NEW SOUTH WALES. Clean Air (J. Clean Air Soc. Australia New Zealand), 3(1):29-36, March 1969. 6 refs.

The New South Wales Department of Public Health set up an Incinerator Committee two years ago to investigate incinerator practices and to set standards of design aimed at minimizing emissions to the atmosphere. The standards which are presented in full in the article apply to domestic (except single family dwellings), commercial, and industrial incinerators. The incinerator standards are based on up-to-date information on incinerator design and practice. In the standards various types of waste material handled by incinerators have been divided into five groups. Multiple chamber design is recommended for incinerators to promote the complete combustion of all solid and gaseous combustibles. Five classes of incinerators have been defined with specifications given for each class.

1749 APTIC NUMBER 17515

Smith, R. G., R. J. Bryan, M. Feldstein, B. Levadie, F. A. Miller, E. R. Stephens, and N. G. White
TENTATIVE METHOD FOR PREPARATION OF CARBON MONOXIDE STANDARD MIXTURES. Health Lab. Sci., 7(1):72-74, Jan. 1970. 22 refs.

Carbon monoxide standards are prepared by the volumetric dilution technique and calibrated by catalytic oxidation to carbon dioxide, with hopcalite used as the catalyst. The CO2 formed is measured gravimetrically by absorption on ascarite. A minimum of 10 mg of CO2 is required to achieve weighing accuracy. Using a 60-liter sample as the required volume, a 10-ppm sample would yield 10.8 mg CO2. For higher CO concentrations, smaller volumes

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of sample can be taken. When pure gases and CO-free dilution air are used, there are no interfering chemical compounds in the calibration procedure. Replicate analyses of CO standards which yield a minimum of 10 mg CO_2 on oxidation agree to within plus or minus 2.5%. Standards from a few ppm to a few percent can be prepared in this manner, with an error of less than 5%. Moreover, CO standards prepared in pressurized tanks show no change in concentration on standing.

LEGAL AND ADMINISTRATIVE

1750 APTIC NUMBER 12238

Adolf, Gustof and Eric Holmquist
GOVERNMENT PROPOSITION NO. 122 IN THE YEAR 1968. HIS MAJESTY'S GOVERNMENT'S PROPOSITION TO THE RIKSDAG CONCERNING THE LIMITATION OF THE SULFUR CONTENT IN FUEL OIL: GIVEN AT STOCKHOLM CASTLE APRIL 19, 1968. (Kungl. Maj:ts proposition nr 122 ar 1968. Kungl. Maj:ts proposition till riksdagen angaende begransning av svavelhalten i eldningsolja; given Stockholms slott den 19 April 1968). 15p., 1968. Translated from Swedish. Franklin Inst. Research Lab., Philadelphia, Pa., Science Info. Services, 26p.

The burning of oil with sulfur content exceeding 2.5% by weight should be prohibited in Sweden after June 30, 1969. The government should be authorized to lower the permitted sulfur content of a fuel oil even further when economic and technical considerations are favorable. A graduation reduction of permissible sulfur content from 2.5% to 1% is anticipated. The responsibility for enforcing the suggested prohibition will be entrusted to provincial governments, who will be permitted to grant exceptions from the prohibition to plants having satisfactory gas purification systems. Local authorities will be granted the right to issue ordinances restricting the sulfur content of a fuel oil below 2.5. Fuel oil dealers will be required to indicate the sulfur content of a fuel oil at the time of its sale. Persons violating the injunction will be subject to a fine or imprisonment. Factors leading to the proposal are the increased acidity of precipitation and surface water in Sweden.

1751 APTIC NUMBER 17581

Benoliel, Jom Tob A., Victoria Valli Braile, and Nissim Cohen Hallale
AIR POLLUTION CONTROL IN THE STATE OF GUANABARA. (Controle da poluicao atmosferica no estado da Guanabara). Institute of Sanitation Engineering, Sursan (Brazil), Publ. 45, 82p., July 1967. 11 refs. Translated from Portuguese. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 82p., Oct. 17, 1969. (Presented at the 4th Congresso Brasileiro de Engenharia Sanitaria, Brasilia, July 23-30, Subject 6.1 - Air Pollution.)

Data for an air-pollution control program in the State of Guanabara is being compiled by a census of industrial equipment and processes, periodic inspection of chimneys at pollution sources, and monthly pollution measurements at 20 sampling stations. The relatively economic program of air quality determination includes measurement of dustfall, total sulfur (lead peroxide cylinder), suspended particulates (Hi-Vol and AISI), and ozone (with strips of rubber). It is expected that this information will lead to the identification of sources of air contaminants and to modifications of existing controls. The information obtained from chimney sampling (with miniature Ringelmann charts) will serve as a guide to the selection of control equipment and the planning of future installations. Allied with the chimney sampling program are determinations of velocity, temperature and humidity of gas, and the concentration of the contaminant. Legislation establishing the Air Pollution Control Service and limiting emissions is presented.

1752 APTIC NUMBER 17472

Duemmler, Friedrich
THE ANTI-AIR POLLUTION ACTIVITIES OF THE TECHNISCHE UEBERWACHUNGS-VEREIN. (Die Technischen Ueberwachungs-Vereine im Dienste des Immissionsschutzes). Text in German. Tech. Ueberwach (Duesseldorf), 10(10):339-345, [illegible] 1970.

One of the most important tasks of [illegible]e Technische Ueberwachungs-Verein (TUV) is to measure dust emissions by steam plants. By checking the performance of new measuring units and determining whether they fulfill the manufacturer's specifications. Measurements by the TUV taken in 1967 on steam boilers with capacities of up to 25 t/h showed that plants without dust collectors emitted on the average 560 mg dust/cu m; those with dust collectors, 170 mg/cu m. For plants with more than 100 Gcal/h, the authorities require the installation of automatic measuring devices for dust and sulfur dioxide. In this connection, TUV checks the available units for suitability and calibrates each individual unit. For dust measurements, photometric units were suitable; for SO2 measurements, infrared absorbers and electroconductivity analyzers were selected. In addition to these activities, TUV is presently engaged with fluorine, hydrocarbon, hydrogen sulfide, sulfur trioxide, carbon monoxide, hydrogen chloride, lead, and zinc oxide measurements. In the years 1965-1966, TUV conducted extensive studies of CO and CH content of automobile exhausts in the idling stage. Infrared absorbers were used for the measurements. Ten percent of the vehicles with four-stroke engines emitted more than 8% CO in the idle; but 45% of the vehicles emitted less than 4.5%. Beginning with October 1, 1970, newly registered automobiles with Otto engines may not emit more than 25 g CO and 1.5 g CH per 100 g fuel consumption. TUV will check the new automobiles for compliance with this law. Finally, odor and noise measurements also belong to the activities of the TUV.

1753 APTIC NUMBER 18088

Gaulding, Clark L.
REGIONAL APPROACH TO AIR POLLUTION ABATEMENT GAINS MOMENTUM. Environ. Sci. Technol., 3(5):431-434, May 1969.

Progress in dealing with air pollution is evidenced by the acceptance of the concept of air quality control regions. The procedure being followed by NAPCA for designating air quality control regions is based on diffusion modeling. Analysis of the basic data on air quality, meteorology, and emissions, together with the computerized modeling results, gives some indication as to the physical dimension of the problem and the required size of the region. After establishment of the technical basis for regional control, the political factors are examined and documented in a report in which the boundaries of the region are proposed. By early March of this year, the first six regions had been proposed and consultations held on the next seven. It is expected that the designation of the first 32 regions will be completed by early fall 1969. By mid-1970, more than 57 air quality control regions will be designated to protect 70 percent of U. S. urban population from air pollution.

1754 APTIC NUMBER 17191

Harada, Shozo
COUNTERMEASURES FOR PUBLIC NUISANCE IN TRANSPORTATION INDUSTRY, TODAY AND TOMORROW. (Unyukotsu jigyo ni okeru kogai taisaku no genjyo to kongo no kadai). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(1):39-44, Jan. 15, 1969.

Public nuisances in the field of transportation are ocean pollution caused by emissions from ships; air pollution by auto exhaust-gas emissions; and aircraft and traffic noise. This study discusses these problems and existing and pending legislation aimed at their control. The major sources of ocean pollution are bilge water, ballast water, and tank cleaning water. The emissions are subject to several regulatory control measures, but stricter enforcement is required. An act prohibiting oil-bearing emissions except bilge water, from ships has been changed to include bilge water. Future control legislation will stress two points: mandatory oily waste disposal systems and compensation for damage caused by emissions. With regard to air pollution by auto exhaust gas emissions, the effect of carbon dioxide on the human body can not be emphasized enough. At present, engine emissions are controlled only by legislation restricting harmful components to below 3 percent.

1755 APTIC NUMBER 17473

Katin, Arno
UNIFORM PRACTICE FOR THE ENTIRE FEDERAL REPUBLIC (OF GERMANY) FOR MONITORING EMISSIONS FROM PLANTS COVERED BY ARTICLE 16 OF THE INDUSTRIAL REGULATIONS. (Bundeseinheitliche Praxis bei der Ueberwachung der Emissionen aus Anlagen nach Paragraph 16 der Gewerbeordnung). Text in German. Tech. Ueberwach (Duesseldorf), 10(6):193-196, June 1969. 1 ref.

Article 16 of the industrial regulations primarily covers power plants, the emissions from which can not yet be limited, due to a lack of suitable cleaning methods. These plants, however, have been required to find the proper stack height so that the gaseous pollutants are sufficiently dispersed. In 1964, all plants emitting more that 25 kg/h of dust or more than 200 k g SO2/h had to install suitable continuously recording emission measuring units. 'Suitable' was defined as being capable of three months of continuous operation without failure. This meant that all dust measuring units were to be subjected to endurance testing which required complex laboratory facilities. Thus, three well equipped laboratories were used for the testing for the entire Federal Republic. Furthermore, it was decided to require calibration of each measuring unit after it had been installed into the plant. Such calibrations were thought necessary to eliminate errors arising under locally different conditions. These costly calibrations made it necessary to limit installation of monitoring units for the time being to plants with a heat capacity of 100 Gcal/h and more.

1756 APTIC NUMBER 18108

Luce, Charles F.
NEW YORK CITY TAKES INVENTORY: HOW CLEAN IS THE AIR. Air. Eng., 11(2):14-16, February 1969.

New York City Local Law 14, although under attack in the courts, is in effect today. The efforts of the New York City administration to comply with this law is discussed. Con Edison, as one of the contributors to pollution, has met or will meet within the established deadlines, every single requirement imposed on the company by Local Law 14. Their attack on the problem is discussed. The problems that exist in the city are reviewed.

1757 APTIC NUMBER 12423

Lutz, G. A., S. B. Gross, J. B. Boatman, P. J. Moore, R. L. Darby, W. H. Veazie, and F. A. Butrico
DESIGN OF AN OVERVIEW SYSTEM FOR EVALUATING THE PUBLIC-HEALTH HAZARDS OF CHEMICALS IN THE ENVIRONMENT. VOLUME II. THE OVERVIEW SYSTEM. (FINAL REPORT). Battelle Memorial Inst., Columbus, Ohio, Columbus Labs., Contract PH-86-66-165, 87p., July 18, 1967. 8 refs.

An overview system was designed that would assist in maintaining a continuous surveillance of chemical contaminants in the environment. To assess properly the difficulties and problems that would confront a surveillance program, as well as provide data on the operation of such a system, five specific chemicals or groups of industry were selected. These included mercury, nickel, vanadium, fluorocarbons, and the chemicals involved in the pulp and paper industry. Information needs were found to fall into five categories: chemical production, secondary product formulation, pattern of chemical usage, chemical toxicology and pharmacology, and environmental health hazards. Four separate features were recognized as essential to an overview center: a good scientific library and information-handling capabilities, ready and convenient access to large pools of scientific competence, an organizational solution for integration of information, and strong managerial ability. The total program for a comprehensive overview of chemical threats to environmental health was judged to require 187 professional man-months of effort plus consultant assistance. It was recommended that an overview center be established within an existing institutional structure possessing the qualifications necessary to provide both information-analysis specialties and a significant multidisciplinary block of professional scientists to immediately provide an internal core for the center. The necessary components of the center itself were identified. The requirements, costs, and recommended methods of operation of the total overview programs were discussed. (Author summary modified)

1758 APTIC NUMBER 12376

Martland, L.
EMISSIONS FROM GASOLINE MOTOR VEHICLES. Inst. of Mechanical Engineers, London (England), Automobile Div., Symp. Motor Vehicle Air Pollution Control, London, 1968, 4p. (Nov. 25-26, Paper 1.)

The British Technical Council (B.T.C.) was started in 1963 and is composed of single representatives from each of the major motor and petroleum companies to provide cooperative consultation and action on technical problems. In the same year the B.T.C. and similar bodies from other West European countries formed the Co-ordinating European Council (C.E.C.). The activities of these organizations in the air pollution matters are outlined, and California and U. S. Federal regulations on pollution are reviewed. The Bureau Permanent International des Constructeurs d'Automobiles, composed of manufacturers' associations from all countries producing motor vehicles, made a strong recommendation to the Economic Commission for Europe in 1966 that air pollution regulations in terms of procedures and levels should be standardized for all countries of Europe. The recommendation was accepted, and subsequently the B.T.C. Fuels Committee contributed significantly to the final European recommendations for control of exhaust emission from gasoline-engine cars and derivatives, to be applied as a type test acceptance. In new U. S. regulations, levels of emissions are controlled on a basis of mass flow instead of proportion of total exhaust gas volume as previously; this aligns with the European method. Although diesel emissions do not constitute a public health hazard the opacity of diesel smoke can be a driving hazard. Odor and deposition from the smoke are also problem areas. Thus the various national and international organizations have more recently initiated programs to design and implement control of diesel emissions as well.

1759 APTIC NUMBER 18069

Miguel, Thomas H.
WHAT FOUNDRYMEN SHOULD KNOW ABOUT AIR POLLUTION CODES. Foundry, 97(3):38-41, March 1969.

One of the toughest problems facing the foundry industry today is that of how to live with present and potential air pollution control codes. Old codes are being tightened, and the new ones are being made stringent from the outset. But perhaps even more of a problem than living with the rigidity of an existing requirement is anticipating the regulations that are to come and finding equipment that will do the job now and, with a reasonable amount of modification, comply with the codes of the future. The following article allows the foundryman who is still in the throes of making equipment decisions to benefit from some of the past mistakes of others and to gain some insight into certain trends that appear to be established. (Author's Abstract)

1760 APTIC NUMBER 17426

BASIS FOR DETERMINING PENALTIES PAID ACCORDING TO THE ACT NO. 35/1967 SB. (Zaklad pro stanoveni pokut podle zakona c. 35/1967 Sb.). Text in Czech. Ochrana Ovzdusi, no. 3:45, 1969.

The Czechoslovakian act No. 35/1967 Sb. is an attempt to include complicated technical, economical, and legal aspects of protection of the atmosphere against pollution into a rather brief legal form. Because of the wide application of the act and the possibility of its ambiguous interpretation, cases which are to be handled according to this act are considered. An interesting point is the basis for determining minimum and maximum penalty limits according to Section 5 of this act. It is emphasized that not only the polluting organization but also the personnel who, by their negligence, violated regulations cited in Section 4, paragraph 1a, b of the act are to be penalized. The pollutors penalized for the first many pay a sum which is at least 50% higher than one twelfth of the regular annual fee, but at most 50% higher than this fee. Repeatedly penalized pollutors will be penalized up to twice the annual fee. The height of the annual fee is specified. As a concrete example, the penalty is calculated for a polluting plant which chimney emitting sulfur dioxide and solid waste.

1761 APTIC NUMBER 12326

Public Health Service, Washington, D. C., National Air Pollution Control Administration
REPORT FOR CONSULTATION ON THE METROPOLITAN KANSAS CITY INTERSTATE AIR QUALITY CONTROL REGION. 50p., March 1969. 11 refs.

In accordance with the Air Quality Act of 1967, a nine-county region is proposed for pollution control in the Kansas City area, comprising Douglas, Johnson, Leavenworth, and Wyandotte Counties in Kansas and Cass, Clay, Jackson, Platte, and Ray Counties in Missouri. The results of urban and engineering surveys are given to provide background information for consultations among Federal, State, and local authorities before final designation of the region. The proposed boundaries would include most air pollution sources and receptors; the major sources are in Clay, Jackson, Platte, Johnson, and Wyandotte Counties, which also have above-background levels of suspended particulates. Depending on meteorological conditions, the outlying counties of Douglas, Leavenworth, and Ray could contribute to or be affected by the core area, and they are included to provide a future buffer zone. The proposed region is expected to contain the projected future population and industrial expansion, and constitutes a logical unit for regional planning and administration, since all the counties either are present members of one or more inter-county organizations or are expected to join in the near future. Pollution emissions were listed as industrial, residential, power plants, transportation, and refuse disposal. Particulate, sulfur oxides, and carbon monoxide emission densities are presented.

1762 APTIC NUMBER 12513

Public Health Service, Washington, D. C., National Air Pollution Control Administration

REPORT FOR CONSULTATION ON THE HARTFORD-SPRINGFIELD INTERSTATE AIR QUALITY CONTROL REGION (CONNECTICUT-MASSACHUSETTS). 55p., April 1969. 12 refs.

The objectives, administration, and major emission sources of the proposed Hartford-Springfield air quality control region are discussed. In this region, the major pollutant emissions coincide with the areas of most dense urbanization and industrialization in central Connecticut and the Lower Pioneer Valley. The pattern of air pollution emissions extends on a north-south axis from Northampton, Massachusetts southward along the Connecticut River and then southwest to Waterbury and New Haven. In general, the most dense pollutant emissions occur in the Springfield, Hartford, New Britain, Waterbury, and New Haven areas. Sulfur dioxide emissions reflect the pattern of power plant and industrial point source locations. Total particulate emissions reflect the geographical concentrations and distribution of the pollutant source-complex. Carbon monoxide emissions provide a measure of the vehicular traffic density distribution over the area. Diffusion models for the three pollutants predict a substantial variation in air quality between heavily populated, industrialized core cities and outlying cities and towns. Core cities such as Springfield, Hartford, Waterbury, and New Haven are at or near centers of high concentrations. The air quality over less densely populated cities appears to be significantly affected by emissions emanating primarily from neighboring high-urbanized cities and towns. Although the inclusion of New Haven and its surrounding area would mean the inclusion of most of central Connecticut's poplulation in one air quality region, an air contrl region must be compatible with and foster cooperative governmental administration of air resources. This condition calls for the separation of central Connecticut's two major metropolitan areas, Hartford and New Haven.

1763 APTIC NUMBER 12340

Ross, Roger W.
TECHNICAL COMMUNICATIONS ASPECTS OF AIR POLLUTION CONTROL WORK. Preprint, National Air Pollution Control Administration, Washington, D. C., Office of Technical Information and Publications, 8p., 1968. 3 refs.

Communication of technology from scientist to scientist and from scientist to layman is of prime importance in the development of methods for combatting air pollution. In the National Air Pollution Control Administration, the dissemination of technical information is the responsibility of the Office of Technical Information and Publications. This office is made up of five sections: the Air Pollution Technical Information Center, the Technical Publications Section, the Technical Audio-Visual Materials Section, and the Technical Methods Section. The Technical Information Center provides current information to the technical air pollution control community. More than 10,000 technical documents published in the United States and foreign countries have been processed and stored by the Center during its first two years of operation. The Technical Publications Section publishes and distributes technical reports, papers, articles, and presentations prepared by Administration personnel. The Technical Audio-Visual Material Section determines the need for and arranges the preparation of photographs, slides, film strips, motion pictures, tapes, records, etc. used by Administration personnel in talks and hearings. The Technical Information Methods Section analyses and evaluates both intra- and extra-mural technical information services. It develops advanced methods of technical information communication and use. Conferences and seminars are arranged by this section.

1764 APTIC NUMBER 18087

Sacco, John F. and Edgar C. Leduc
AN ANALYSIS OF STATE AIR POLLUTION CONTROL EXPENDITURES. J. Air Pollution Control Assoc., 19(6):416-419, June 1969. 6 refs.

Air pollution control, a significant problem facing state governments, receives a varying amount of fiscal resources in each state. The purpose of this paper is to examine social, economic, and political factors that may be related to state air pollution control expenditures. The indicators of the social-economic factors are urbanization, industrial pollution potential, income, and industrialization. The indicators of the political system are interparty competition, malapportionment, voter participation, local control effort, and general state expenditure efforts. The findings show that the few states expending for air pollution control in 1963 were, for the most part, characterized by a high level of economic development. In 1967, states at all levels of economic development allocated revenues for air pollution, although the more developed continued to hold an edge. In neither year did the political variables differentiate between levels of expenditure. The reasons advanced for the expenditures in 1967 are assessed to be the result of federal grants, the vigorous effort put forth by state control officials, and the increased public concern for the problem. (Author's Abstract)

1765 APTIC NUMBER 12511

Stumph, Terry L. and Robert L. Duprey
TRENDS IN AIR POLLUTION CONTROL REGULATIONS. Preprint, Air Pollution Control Association, New York City, 40p., 1969. 19 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 62nd, New York, June 22-26, 1969, Paper 69-175.)

Recent trends in air pollution control regulations adopted by state and local agencies were analyzed. Emphasis was on the concepts of control regulations rather than on specific emission limits. Trends in control regulations are towards preventing air pollution through required application of known control techniques. Outmoded concentration emission standards are rapidly being replaced by those that limit total mass-emission rates. Allowable emission rates usually vary according to the size of the source. Control of all visible emissions is being accepted as necessary to any control program. Particulate matter from fuel-burning equipment is being controlled to a high degree; emission standards for sulfur oxides from fuel combustion are anticipated in the near future. Incinerator emissions standards are relatively undeveloped, due to lack of knowledge about the performance of high-efficiency dust collectors on these sources. Control of many types of process industries presents a challenge in the design of equitable emission standards. The familiar process-weight-rate regulation is rapidly becoming the standard for limiting particulate matter from this source category. The potential-emissions-rate concept shows promise for certain source types and pollutants. Odor regulations have mainly involved ambient air measurements using the human sense of smell. (Author abstract modified)

1766 APTIC NUMBER 12329

Yamada, Victor H.
CURRENT PRACTICES IN SITING AND PHYSICAL DESIGN OF CONTINUOUS AIR MONITORING STATIONS. Preprint, Air Pollution Control Association, New York City, 21p., 1969. (Presented at the Air Pollution Control Association, Annual Meeting, 62nd, New York, N. Y., June 22-26, 1969.)

Current practices in siting and physical design of continuous air monitoring installations were determined by a survey of air pollution control agencies in the U. S. The typical air pollution control agency budget is $125,000 and it has two continuous monitoring stations. Network objectives are to obtain current readings and to evaluate long-range trends. The network obtains data on particulate matter, sulfur dioxide, carbon monoxide, nitrogen oxides, oxidants, and hyrocarbons. Meteorlogical data obtained include wind speed and direction and relative humidity from instruments at monitoring stations and the local weather bureau. The typical monitoring station collects data on general air quality and localized effects. The main sample inlet line is vertical and projects five ft above the roof. The inside diameter of the line is 1/2 in., and the line is 14 ft long. The inlet line is made of glass. A secondary line is used for measuring particulate matter with a tape sampler. The station is located on the ground floor and is situated in a commercial land-use area. (Author summary modified)

SOCIAL ASPECTS

1767 APTIC NUMBER 17469

Association for the Prevention of Industrial Public Nuisance (Japan)
SYMPOSIUM OF INDUSTRY AND PUBLIC NUISANCE CONTROL. (Kigyo to kogai taisaku zadankai). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 6(1):5-8, Jan. 15, 1970.

Ways of reconciling industrial and public attitudes toward air pollution control are discussed. It is pointed out that, even with the enactment of emission standards, it is difficult to achieve a balance between industrial development and preservation of the human environment. A compromise is required, since Japan is a highly industrialized country, largely dependent on imported raw materials. Facts are presented to illustrate that current public opinion is one-sided, placing the major emphasis on the responsibility of industry at the neglect of an objective scientific and practical approach to pollution control. This viewpoint is reflected in the government's approach to public nuisance control administration and in the enactment of regulations probably more severe than those found in Europe and the United States. This attitude toward industrial development may lead to a lower living standard. While the present state of air pollution is due to too rapid economic growth, it must be realized that effective pollution controls will not be achieved by industry unless substantial and qualitative government support and public understanding are forthcoming.

1768 APTIC NUMBER 11814

Beck, James and Marianna Stapel
THE ROLE OF THE PUBLIC IN THE CONTROL OF AIR POLLUTION. PART II. In: Air Pollution Project: An Educational Experiment in Self-Directed Research, Summer 1968. Associated Students of the California Inst. of Tech., Pasadena, p. 195-222, 1968. 31 refs.

If air pollution is to be substantially reduced, control devices for internal combustion engines must be improved or alternative means of transportation found. Among suggested low-emission transportation systems are electric- or steam-powered automobiles, large-scale rapid transit systems, commuter car pools, or a combination of these transport modes. However, public animosity towards these alternatives could hamper the development of a new transportation system. This paper discusses the merits of circle comparison and slide comparison tests in determing what is valued in today's automobile in terms of performance, comfort, and convenience. With this knowledge, the choice of a psychologically acceptable transportation system should be an easier task for decision makers. Of the two tests, the slide comparison test would provide the most valuable results.

1769 APTIC NUMBER 17508

Miyawaki, Akira
SOME CONSIDERATIONS OF THE ENVIRONMENTAL POLLUTION CONTROL AND PHYTOSOCIOLOGY. (Kogai to shokubutsu shakaijaku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 6(4):251-258, April 15, 1970.

The environmental pollution problem is discussed from the biological viewpoint. Evidently human activities in every sphere of modern industrial life have contributed to disturbing the balance between nature and human beings. It is very dangerous for humans to rely too much on their wisdom and to pursue material development at the expense of natural laws; in terms of animate things composed of carbon, oxygen, hydrogen, and nitrogen, there is no substantially basic difference between living things and a human being. As long as human beings carry on within a circle of the nature as a member of a biological group the relationship between their function and the environment cannot be exterminated. Too much destruction of the natural balance or too rapid change of the living environment will cause destruction of human beings themselves. It is important for man to coexist with nature which provides him the basic substances for his survival as a member of the biological world. The environmental pollution problem, therefore, should be taken as a warning from nature that the preservation of the living environment is in jeopardy. A realistic approach to protecting the natural balance requires an understanding of the biological order.

1770 APTIC NUMBER 17789

Sargent, Frederick, II
ADAPATIVE STRATEGY FOR AIR POLLUTION. BioScience, 17(10):691-697, Oct. 1967. 33 refs. (Presented at the Illinois Public Health Association 27th Annual Meeting, 'Air Pollution Control' Session, Peoria, Ill., April 7, 1967.)

The fundamental goal of an adaptive strategy is to manage the quality of the renewable resources of air, water, and land to yield the greatest net benefit to society. For an adaptive strategy on air pollution to be effective, it must treat air pollution ecologically, regulating industrial growth so that the wastes of technology will not irreparably destroy the fitness of the ecosystem. Formulation of an effective strategy requires an understanding of the four air pollution problems facing man at this point in time: inadvertent modification of weather and climate, atmospheric dispersal of pollutants, the effect of pollution on plants, and the effect of pollution on human health. An analysis of these problems shows that there are at least two potential weak links in the ecosystem: the green plant and the human being. Both show some evidence of adaptability to air pollution, but the adaptability of the plant may disrupt the metabolic flow of the system. This has serious implications, for the plant is the primary producer of nutrient energy for the hierarchy of dependent consumers, including man. Consequently, to insure his survival, man must establish a set of rules for resource management. The success of these rules will depend on man's ability to see himself in the perspective of the ecosystem and on informed political decisions on complex ecological matters.

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1771 APTIC NUMBER 11862

Schusky, Jane
PUBLIC AWARENESS AND CONCERN WITH AIR POLLUTION IN THE ST. LOUIS METROPOLITAN AREA. Southern Illinois Univ., Edwardsville, Public Administration and Metropolitan Affairs Program. Contract PH 86-63-131, 82p., May 1965. 12 refs.

A metropolitan area public opinion survey was conducted in St. Louis to determine the nature and extent of the air pollution problem as perceived by the residents; to determine the accuracy and extent of public knowledge of air pollution and its effects; to discover the sources of the knowledge; and to determine the readiness of the public to accept and support the various elements of a control program. Clean air was more important to surburbanites than to city dwellers. The city population was more concerned with social problems, such as juvenile delinquency and unemployment. No single problem appeared to be a determinant of the rating of a community as a place to live. Survey data also showed that the residents' rating of the effectiveness of their officials was related to their community as a place to live, and was also related to their perception of the seriousness of various problems. Almost 50% of the entire metropolitan population said air pollution was somewhat bothersome. Nine out of 10 residents thought air pollution adversely affected health, and the more highly educated made the connection almost unanimously. However, a large portion of those afflicted with ailments to which air pollution is strongly implicated as a contributory factor stated that they were not bothered by air pollution. In defining air pollution, more than 50% listed odor; smoke was second in importance. Data on the effectiveness of the mass media in communicating air pollution information showed a somewhat inconsistent pattern. Although the perceived seriousness of air pollution as a problem did not relate to a respondent's reading about pollution in the newspaper or hearing about it on television or radio, the interest of the respondent did not relate to such exposure. The more serious the resident thought air pollution was, the more he was inclined to feel that government and industry were not doing enough to control it. Eighty five percent of the residents were willing to contribute $1 a year in taxes to control pollution. A bi-state control agency was generally supported for St. Louis. (Author summary modified)

1772 APTIC NUMBER 17553

Shoji, Hikaru
CAPITALISM AND PUBLIC NUISANCE. (Shihonshugi to kogai). Text in Japanese. Horitsu Jiho (Law Review), 41(11):4-12, Sept. 1, 1969. 17 refs.

The relationship between capitalism and air pollution, which is construed to be analogous with industrial pollution, is analyzed. The concept of air pollution varies according to individual interests or viewpoints. The article questions the ability of the Law of Air Pollution Control to define a public nuisance, the legal concept of which is confined to description and illustration of general pollution phenomena. In discussing air pollution, there are three factors to consider: its cause, the phenomena presented, and the extent of damage. Concrete examples of the latter are needed to correlate cause and effect. It may be monistic to relate the occurrence of pollution solely to capitalism since socialist countries also experience it. However, to identify industrial pollution in a capitalist society with one in a socialist society is to confuse the issue because socialist countries have had to emphasize production at the expense of the living environment. Moreover, these countries, being classless, are capable of achieving a goal of industrial pollution control rapidly. The history of industrial pollution is the history of capitalism; the current status of pollution in Japan is attributed to unreasonable and excessive concentration on industrial and economic growth. A concerted public drive against pollution is required.

1773 APTIC NUMBER 11809

Silverblatt, Helene, Marcia Weiss, Nick Smith, Judy Smith, Sheila McEnuerney, David Green, and Ellen Cederbaum
A SURVEY OF THE PASADENA COMMUNITY ON AIR POLLUTION. In: Air Pollution Project: An Educational Experiment in Self-Directed Research, Summer 1968. Associated Students of the California Inst. of Tech., Pasadena, p. 75-131, 1968. 40 refs.

A random survey of approximately 250 residents showed that the majority of residents of Pasadena consider air pollution a serious problem and are not satisfied with present control measures. When asked if they had ever wanted to complain about pollution, 39.3% of those polled replied that they had. Of these, 28.1% had actually filed a complaint. Nearly 70% of those interviewed found the air pollution level undesirable or worse. Most residents thought of the effect of pollution in terms of eye irritation. The frequency of this response was followed by complaints about nose and throat irritation and frequent haze or fog. About 90% of the public sampled indicated a willingness to pay between $1.50 and $2.00 a month in taxes for air pollution research; about 63.5% were willing to pay $25 for an automotive smog control device. It is suggested that the survey be repeated in Long Beach, which is similar to Pasadena in terms of population density, age of residents, and income.

GENERAL AND MISCELLANEOUS

1774 APTIC NUMBER 12307

Harris, Robert L., Jr.
AIR POLLUTION. Preprint, Ohio Cooperative Extension Service, Columbus, Ohio Dept. of Agriculture, Columbus, and Ohio Agricultural Council, 16p., 1969. (Presented at the Conference on Pollution Control - Air, Soil, Water, Columbus, Ohio, Feb. 13, 1969.)

After a brief general discussion of air pollution, the interrelationships between air pollution and agriculture are enumerated. Serious effects on agricultural crops and livestock are caused in particular by atmospheric sulfur dioxide, photochemical oxidants, and fluorides. At the same time, many agricultural operations add to air pollution. Prescribed forest burning, burning of logging debris or for range improvement or seed bed preparation, and burning of crop residues for disease and pest control add millions of tons of particulate matter to the air. Windblown soil, much of which results from agricultural tillage, is distributed through the atmosphere for great distances. Use of pesticides has created an entire range of pollution problems, and agricultural industries such as alfalfa dehydrating, cotton ginning, grain milling, and animal products processing cause serious emissions, often of odorous pollutants. The major elements of the Federal air pollution control program are outlined, including a brief description of the Air Quality Act of 1967, of the designation of air quality control regions, and of some of the problems involved in determining air quality standards and criteria.

1775 APTIC NUMBER 11871

Hashimoto, Michio
AIR POLLUTION PROBLEMS BY AUTOEXHAUST IN JAPAN. Preprint, Ministry of Health and Welfare, Tokyo, Japan, Bureau of Environmental Sanitation, 7p., 1968 (?).

Current air pollution measurement and control programs are presented with special focus on automobile exhausts. Since 1964, the National Hygiene Laboratory of the Ministry of Health and Welfare has operated 3 continuous air monitoring stations to determine carbon monoxide, nitric oxide, particulate matter, nitrogen dioxide, sulfur dioxide, and lead concentrations. Simultaneously, the wind speed, direction, temperature, and humidity were recorded and traffic counts were taken. The CO and nitrogen oxides concentrations were on an upward trend while the particulate matter decreased. Based on the experience of the 3 monitoring stations, a National Air Sampling Network Program was inaugurated in 1965. The network will comprise 20 stations, 7 of which are already in operation. In 1966, a special diffusion study using the air tracer system was carried out. In 1965, a study of the effects of air pollution by automobile exhausts on humans was conducted. People living along busy streets as well as 20-year-old nonsmokers and non-smoking policemen were selected for the study. The air pollution concentration (spot tests) was likewise measured. A significant difference of the carboxyhemoglobin content was found between people living in the polluted area and the control group. Pulmonary function tests revealed a slightly higher function. In 1966, emission standards for all new car models were established. In December of 1967, idling adjustment screw conditioning was recommended for all used cars.

1776 APTIC NUMBER 16578

Johnson, David Larry
UNIT ON AIR POLLUTION. Thesis (M.S. Ed.), Utah Univ., Salt Lake City, Dept. of Science Education, August 1968, 168p. 109 refs.

Information was obtained on the various types and sources of air pollution and their effects on animal and plant life for use as a teaching unit on air pollution. The evolution of the atmosphere was traced from its beginning to the present and then analyzed. Common natural air pollutants such as particles from sea spray, volcanic eruptions, meteoric dust, natural combustion, terrestrial dust, pollen, bacteria, and fungal spores were discussed. Unnatural air pollutants which include particulate matter, sulfur oxides, nitrogen oxides, hydrocarbons, and carbon monoxide were discussed with reference to transportation, manufacturing, electric power generation, space heating, and refuse disposal. The effects of air pollution on such diseases as emphysema, chronic bronchitis, and cancer were presented, as well as the effects on vegetation. Many agricultural areas were destroyed for the cultivation of many sensitive species by the continual presence of pollutants. Extensive damage has resulted to many forest species in areas where controls were not used for escaping pollutants. Methods being employed to combat air pollution were listed as inertial separation, scrubbing, agglomeration, adsorption, and engine modifications to reduce tailpipe exhaust emissions. Advances in the development of engineering control devices are expensive and not totally effective. Controls are not developed for many processes. Other methods of control such as zoning, site selection, performance standards, and regional air-shed developments were proposed as effective methods of pollution abatement. (Author abstract modified)

1777 APTIC NUMBER 11709

National Swedish Inst. for Building Research, Stockholm, Sweden
QUALITY OF DWELLINGS AND HOUSING AREAS. Rept. 27:67, 146p., 1967. (p. 71-73 directly concern air pollution).
CFSTI: PB 178685

The methods of appraisal used in various countries in assessing the need for slum clearance are illustrated; within the context of urban renewal and new development, the standards, norms, and regulations concerning characteristics of dwellings and housing areas are discussed. Powers available to public authorities for formulating and enforcing standards of housing and related community facilities are summarized. The document comprises the first part of an inquiry carried out under the auspices of the Committee on Housing, Building and Planning of the United Nations Economic Commission for Europe. It contains three chapters. The first discusses the various aspects of the subject and reports briefly the results of analytical work. The remaining portions summarize the information received from various governments and present conclusions and recommendations for follow-up work. Units of measurement used in air pollution control, smoke emission standards, and the administration of standards are reviewed on pages 71 to 73. Frequent units of measure include airborne impurities: weight units per standard area per unit of time; physicochemical impurities: weight units per volume units; and town planning factors: width of protective zones of factories, parking places, and highways. Standards refer to emission of impurities and town planning. Control refers to enforcement by legislation and by planning norms for new development.

1778 APTIC NUMBER 17526

Tokyo Inst. of Tech. (Japan), Kiyoura Lab.
ABATEMENT OF AIR POLLUTION, I-(3) COUNTERMEASURE FOR SULFUR DIOXIDE IN WEST GERMANY AND PERMISSIBLE CONCENTRATIONS. (Aryusan haigasu ni yoru kogai bojoho.(sono III) Nishi-doitsu no SO2 osen taisaku to saiko kankyo nodo). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 1(3):181-184, July 15, 1965.

The West German Verein Deutsher Ingenieure (VDI) - Kommission Reinhaltung der Luft reports on air pollution standards and control procedures. In the absence of approved abatement methods, permissible standards for gaseous SO2 are not specified by law. The VDI committee consists of scientists and delegates from twenty two societies. According to them, men unfamiliar with SO2 will cough for a short while after exposure to 4 cu cm SO2/cu m air. The influence of SO2 on animals varies according to species. Its influence on plants is seen in color changes in the outside tissues of leaves. Cell damage occurs within a few hours after exposure to 1-2 cu cm SO2/cu m air. Chronic injuries appear after long exposure to low concentrations of SO2. The degree of injury is contingent on plant type and surrounding conditions. The permissible density of SO2 is 0.15 cu cm SO2/cu m air. Sulfurous and sulfuric acid corrode buildings.

SUBJECT INDEX

The terms listed in this subject index are those that most closely describe the information presented in the abstracts. Instead of the APTIC number, the NAPCA ABSTRACT BULLETIN (NAB) number is used to identify the abstracts. The NAB number is shown in the upper left corner of each abstract. This issue includes NAB numbers 1251 - 1778, which are tabulated below to facilitate use of the index.

Category	NAB Number
Emission Sources	1251 - 1308
Control Methods	1309 - 1400
Measurement Methods	1401 - 1497
Air Quality Measurements	1498 - 1519
Atmospheric Interaction	1520 - 1562
Basic Science and Technology	1563 - 1646
Effects-Human Health	1647 - 1713
Effects-Plants and Livestock	1714 - 1734
Effects-Materials	1735 - 1741
Economic Aspects	1742 - 1744
Standards and Criteria	1745 - 1749
Legal and Administrative	1750 - 1766
Social Aspects	1767 - 1773
General and Miscellaneous	1774 - 1778

SUBJECT INDEX

Absorption: 1315, 1316, 1337, 1340, 1378, 1381, 1566, 1569, 1613, 1646, 1541, 1443

Adsorption: 1319, 1324, 1578, 1588, 1619

Afterburners: 1357, 1379, 1392, 1272

Air Quality Criteria: 1725

Air Quality Measurements: 1506, 1507, 1510, 1513, 1514, 1518, 1431, 1436, 1460, 1480, 1481, 1496

Air Quality Standards: 1725, 1656, 1778

Air Resource Management: 1753, 1761, 1762, 1770

Aircraft: 1286

Aldehydes: 1494

Aliphatic Hydrocarbons: 1564, 1567, 1596, 1404, 1410, 1423, 1256, 1257, 1280, 1683, 1450, 1482, 1490

Ammonium Compounds: 1665

Area Surveys: 1498, 1503, 1509, 1546

Aromatic Hydrocarbons: 1374, 1574, 1596, 1599, 1410, 1423, 1283, 1296, 1297, 1677, 1683, 1480, 1481

Asia: 1341, 1342, 1343, 1359, 1364, 1365, 1366, 1372, 1273, 1281, 1290, 1506, 1510, 1519, 1686, 1692, 1706, 1463, 1738, 1775

Atmospheric Movements: 1585, 1521, 1529, 1530, 1535, 1537, 1542, 1552

Automotive Emission Control: 1309, 1325, 1372, 1376, 1357, 1255, 1268, 1278, 1283, 1296

Automotive Emissions: 1312, 1396, 1615, 1406, 1410, 1255, 1256, 1257, 1258, 1259, 1268, 1272, 1277, 1279, 1283, 1290, 1299, 1308, 1501, 1687, 1699, 1437, 1443, 1448, 1450, 1758, 1775

Benzopyrenes: 1731, 1505, 1518, 1481

Boilers: 1263, 1269, 1742

Bronchitis: 1653, 1700, 1712

By-Product Recovery: 1321, 1322, 1331, 1344, 1356, 1374, 1384, 1400

Cadmium Compounds: 1681

Calibration Methods: 1454, 1491

Cancer: 1703, 1712, 1713

Carbon Monoxide: 1312, 1560, 1576, 1610, 1615, 1629, 1637, 1299, 1512, 1488, 1749

Carcinogens: 1423, 1505, 1518, 1677, 1685, 1690

Catalysis: 1370, 1385, 1568, 1609, 1614, 1628

Catalytic Oxidation: 1326, 1357, 1379, 1568, 1609, 1637

Centrifugal Separators: 1330, 1333, 1345, 1390, 1391, 1398

Chemical Reactions: 1583, 1590, 1600, 1607, 1627, 1628, 1629, 1643

Children: 1648, 1649, 1665, 1674, 1697, 1705, 1710

Chlorine Compounds: 1567, 1628, 1643

Circulatory System: 1709, 1468

Coal: 1329, 1377, 1263, 1266, 1276

Colorimetry: 1452, 1462, 1465, 1476, 1488, 1490, 1492, 1494

Combustion Products: 1313, 1330, 1366, 1384, 1386, 1607, 1416, 1426, 1273, 1302, 1487

Condensation (Atmospheric): 1526, 1540, 1552

Construction Materials: 1254, 1286

Control Agencies: 1752

Control Programs: 1751, 1757, 1761, 1762, 1775

Corrosion: 1605, 1735, 1736, 1737, 1738, 1742

Costs: 1742, 1743, 1744, 1764

Crops: 1714, 1721, 1722, 1723, 1724, 1725, 1733

Design Criteria: 1364, 1268, 1281, 1740, 1746, 1748, 1766

Desulfurization of Fuels: 1332, 1329, 1363, 1367, 1385, 1389

Diesel Engines: 1357, 1253, 1256, 1257, 1277, 1279, 1448

Dispersion: 1520, 1522, 1523, 1531, 1532, 1534, 1535, 1537, 1543, 1546, 1548, 1558

Dust Fall: 1508, 1545

Economic Losses: 1742

Electric Power Production: 1744, 1263, 1292, 1301, 1555, 1755

Electrochemical Methods: 1586

Electrostatic Precipitators: 1341, 1342, 1364, 1394, 1398, 1563, 1420

Emission Inventories: 1267, 1304, 1507

Enforcement Procedures: 1760

Epidemiology: 1552, 1672, 1708

Europe: 1264, 1271, 1284, 1503, 1504, 1505, 1508, 1514, 1517, 1547, 1549, 1649, 1653, 1712, 1447, 1737, 1750, 1755, 1760

Exposure Methods: 1579, 1616, 1652, 1659, 1670, 1682, 1688

Filters: 1324, 1339, 1353, 1358, 1359, 1360, 1383, 1386, 1595, 1633

Flame Ionization Detector: 1404, 1450

Fluorine Compounds: 1347, 1630, 1660, 1459

Food and Feed Operations: 1379

Fuel Additives: 1297

Fuel Gases: 1332, 1367, 1298, 1299, 1303

Fuel Oils: 1326, 1385, 1389, 1295, 1302, 1750

Furnaces: 1262, 1269, 1287

Gas Chromatography: 1406, 1419, 1467, 1468, 1482

Subject Index

Gas Sampling: 1308, 1487

Gas Turbines: 1258

Gasolines: 1312, 1278, 1493, 1758

Hematology: 1688

Hydrochloric Acid: 1352, 1571

Hydrogen Sulfide: 1321, 1356, 1371, 1374, 1375

Incineration: 1251, 1252, 1260, 1264, 1269, 1281, 1284, 1287, 1746, 1748

Iron Compounds: 1438

Isotopes: 1573, 1574

Kraft Pulping: 1388, 1275

Laboratory Animals: 1501, 1654, 1669, 1670, 1679, 1680, 1681, 1685, 1690, 1700

Lasers: 1584, 1433

Lead Compounds: 1403, 1648, 1652, 1493

Legal Aspects: 1750, 1754, 1755, 1756, 1759, 1760, 1765

Light Radiation: 1592, 1541, 1547, 1549

Light Scattering: 1620, 1425, 1429, 1527, 1451, 1453

Manganese Compounds: 1659, 1492

Mathematical Analyses: 1697

Mathematical Modeling: 1625, 1543, 1560

Maximum Allowable Concentration: 1668, 1745, 1778

Metal Compounds: 1581, 1614, 1619, 1637, 1643, 1415

Metals: 1605, 1285, 1693, 1735, 1736, 1738

Methanes: 1285

Microorganisms: 1339, 1504, 1528, 1455

Mineral Processing: 1266

Monitoring: 1715, 1407, 1416, 1422, 1517, 1435, 1436, 1447, 1448, 1450, 1451, 1463, 1471, 1472, 1474, 1496, 1755, 1766

Nickel Compounds: 1285

Nitrates: 1739

Nitrogen Oxides: 1313, 1565, 1588, 1592, 1596, 1600, 1610, 1615, 1299, 1665, 1669, 1678, 1682, 1683, 1690, 1691, 1452, 1457, 1465, 1467, 1468, 1487

Odorimetry: 1479, 1486, 1495

Odors: 1379, 1387, 1397, 1645, 1702, 1479

Open Burning: 1251

Oxidants: 1718, 1719, 1734, 1422, 1517, 1683, 1710, 1476

Ozone: 1631, 1716, 1718, 1722, 1728, 1729, 1412, 1422, 1542, 1654, 1682, 1476

Particle Counters: 1440, 1446, 1449, 1451

Particle Size: 1584, 1276, 1440, 1449, 1464, 1466, 1485

Particulate Sampling: 1414, 1418, 1466, 1483, 1484, 1485

Particulates: 1333, 1338, 1341, 1342, 1343, 1345, 1350, 1358, 1361, 1366, 1383, 1390, 1391, 1563, 1578, 1582, 1584, 1591, 1598, 1611, 1612, 1620, 1633, 1641, 1401, 1402, 1407, 1414, 1418, 1425, 1428, 1274, 1291, 1293, 1294, 1297, 1500, 1503, 1511, 1522, 1523, 1527, 1545, 1557, 1647, 1696, 1703, 1713, 1431, 1432, 1438, 1451, 1456, 1458, 1464, 1466, 1481, 1491

Petroleum Refining: 1314. 1322, 1354, 1371, 1400, 1731

Phosphorus Compounds: 1583

Photochemical Reactions: 1564, 1565, 1567, 1596, 1601, 1623, 1624, 1644

Photometric Methods: 1444

Plans and Programs: 1766

Plastics: 1600, 1254, 1306

Plume Behavior: 1524, 1555

Polynuclear Compounds: 1426, 1458

Precipitation: 1526, 1531

Primary Metallurgical Processing: 1320, 1341, 1342, 1346, 1347, 1361, 1391, 1394, 1398, 1642, 1416, 1267

Pulmonary Function: 1692

Radioactive Radiation: 1301, 1545

Reaction Kinetics: 1613, 1615

Reaction Mechanisms: 1560

Respiratory Diseases: 1504, 1673, 1691, 1704, 1706, 1710, 1712

Respiratory Functions: 1684

Respiratory System: 1651, 1654, 1664, 1669, 1679, 1680, 1682, 1684, 1709

Samplers: 1408, 1414, 1420, 1427, 1511, 1432, 1442, 1447, 1454, 1455, 1456, 1464, 1483, 1485, 1487

Scrubbers: 1320, 1340, 1351, 1352, 1361, 1578

Simulation: 1587, 1639

Smog: 1587, 1639, 1718, 1727, 1734

Solvents: 1327, 1337, 1261, 1288, 1306, 1693

Source Sampling: 1502, 1510

SO2 Removal (Combustion Products): 1310, 1311, 1315, 1317, 1331, 1334, 1335, 1348, 1363, 1373, 1381, 1392, 1399

Spark Ignition Engines: 1299

Spectrometry: 1592, 1610, 1433, 1457

Spectrophotometry: 1426, 1476, 1489

Sulfur Compounds: 1322, 1344, 1365, 1388, 1624, 1635, 1646, 1405, 1253, 1266, 1270, 1276, 1295, 1534, 1647, 1696, 1741, 1750

Subject Index

Sulfur Oxides: 1323, 1331, 1365, 1370, 1377, 1382, 1386, 1567, 1568, 1569, 1571, 1580, 1583, 1590, 1599, 1608, 1609, 1618, 1623, 1627, 1628, 1629, 1640, 1642, 1646, 1716, 1720, 1721, 1405, 1305, 1500, 1503, 1514, 1534, 1647, 1664, 1396, 1435, 1443, 1444, 1457, 1462, 1472, 1478, 1487, 1489, 1778

Testing Facilities: 1700, 1437

Toxicity: 1647, 1678, 1682, 1683, 1687, 1689, 1693

Transportation: 1754

Trees: 1716, 1720, 1723, 1730

Urban Areas: 1359, 1290, 1509, 1515, 1530, 1649, 1698, 1496

Vanadium Compounds: 1609

Vehicles: 1586, 1251, 1258, 1259, 1265, 1272, 1290, 1699, 1758

Visibility: 1499, 1502

AUTHOR INDEX

All personal authors are listed together in this index. First authors are not separated.

AUTHOR INDEX

ABERSOLD J N 1556
ABILOCK R 1585
ADACHI S 1706
ADACHI T 1563
ADAMS D F 1405
ADOLF G 1750
AGA R L 1326
AHLQUIST N C 1527
AIZAWA R 1385
AKSENOVA V B 1676
ALBERS C 1468
ALCOCER A E 1402
ALKIRE H L 1498
ALPISER F M 1251
ALTSHULLER A P 1564
1565

AMANAT M 1711
AMDUR M O 1647
ANDREATCH A J 1404
ANTAL A 1648
ARAI Y 1566
ARDAR G 1390
ARDEVAN E 1648
ASAKAWA C 1348
ASINGER F 1567
ASTASHEVA A A 1381
ATKISSON A A JR 1309
ATKISSON A A 1430
ATSUKAWA M 1310
1311
AVER YANOV A G 1745

BABA T 1290
BABAYANTS R A 1649
BABUSHKINA M D 1608
BADDOUR R F 1568
BAILEY A L 1266
BAILEY C L 1312
BAIR W J 1636
BALASHEV B N 1650
BALEJ J 1569
BAMESBERGER W L 1405
BARCAL R 1732
BARDE R 1570
BARNHART D H 1313
BARRETT E W 1520
BASYE D 1314
BATINA T L 1416
BAUM F 1521
BAUME G 1571
BEALE C O 1398
BEAN E H 1329
BECK J 1768
BECKER W H 1708
BECKETT J C 1651
BEEBE R G 1499
BELLAR T A 1406
BELLI R 1652
BENARIE M 1407
1408
1522

BENDER F W 1716
BENOLIEL J T A 1751
BERNERT J 1409
BEUTNER H P 1315
BEZUGLYI V D 1572
BIEBERDORF F W 1723
BIER K 1573
BIERSTEKER K 1653
BILLER W F 1410
BILS R F 1654
BINDER H 1583
BINGER W W 1735
BLAIR W H 1669
BLANCO A J 1538
1597

BLISS H 1576
BLOCK H 1252
BOATMAN J B 1275
1757

BODE W 1253
BODIN D 1407
BOETTGER O 1574
BOGATYREV V L 1316
BOKOV A N 1254
BONAMASSA F 1430
BORGWARDT R H 1317
BORUSS L 1575
BOSWELL J 1318
BOUBEL R W 1294
BOUDREAU R D 1411
BOUQUIAUX J 1500
BOWMAN D H 1352
BOYD W A 1412
BRAILE V V 1751
BRAIN J D 1664
BRANDT C S 1714
1726

BRENNAN E 1721
BREUER W 1413
BRINK J A JR 1414
BRINKMAN P D 1709
BRITTAN M 1576

BROWN D R 1376
BROWN M J 1553
BROWN R H 1735
BRUBACHER M L 1255

BRUNNER E 1371
BRUSTAD T 1577

BRYAN R J 1749
1488
1501

BUFALINI J J 1422
BURLESON F R 1739
BUTRICO F A 1275
1757

BUU HOI N P 1677
BYKHOVSKAYA M S 1415
BYZOVS N L 1523

CAHEN R M 1326
CALVERT J G 1623
CALVERT S 1578
CALVERT W R 1319
CAMPBELL W W 1320
CAMPBELL K I 1579
CAMPBELL F S 1717
CARETTO L S 1637
CARNEY D J 1416
CARPENTER S B 1555
CARSON J E 1524
CASSELL E J 1655
CEDERBAUM E 1773
CHALIKOV D V 1525
CHANGNON S A JR 1526
CHAPMAN T W 1621
CHARLSON R J 1527
CHEVALIER C E 1256
1257

CHIRONIS N P 1258
CHOLAK J 1454
CHUONG B T 1408
CHURCH H W 1543
CHUTE A E 1322
CITARELLA J F 1744
CLARK J M 1277
CLARK L E 1472

CLARK R 1262
COFFEY W L 1460
COHEN N 1580
COLBAUGH W C 1555
COLLIS R T H 1417
COMROE J H JR 1657
COUPER D W 1453
COREY R C 1481
1482

CORN M 1466
COUCHMAN J C 1418
COULEHAN B A 1448
CRAMERS C A 1419
CRAXFORD S R 1503
CRENTZ W L 1266
CRIDER W L 1579
CROUSE W R 1261
CURTIS J J 1420
CYR R 1412

DAINES R H 1721
1728

DARBY K 1394
DARBY R L 1275
1757

DARLEY E F 1715
1324

DATSENKO D F 1638
DAVIES R R 1504
1528

DAVIS D L 1325
DAVIS J A 1262
DEACON A J 1416
DEANE M 1672
1673

DEBUS H R 1326
DEHAAS G G 1388
DELAND, R J 1530

DELARUE G 1581
DELUISI J J 1421
DEMOLE V 1658
DENNIS M W 1661
DEURINGER R 1435
DICKEL G 1573
DIEHL E K 1313
DINGLE A N 1531
DIRSCHERL W 1590
DMITRIEVA V N 1572
DOCHINGER L S 1716
DOKUCHAEVA F V 1659
DOOLEY A E 1481
1482

DOSA I 1390
DOST F N 1660
DOUGLAS J S 1661
DUBOIS J 1570
DUDINA Y D 1254
DUDLEY J E 1422
DUEMMLER F 1752
DUHME A 1252
DUNNILL M S 1704
DUPREY R L 1765
DUUREN V B L 1423
DUVAL C 1593
DUZY A F 1263
DWYER J 1537

EATON L R 1582
EBENEDER F 1567
EBERHARDT H 1264
EGI K 1385
EHRLICH R 1669
ELDERKIN C E 1537
ELLIOTT J H 1327
EMERSON W S 1315
EMIK L O 1725

Author Index

ENKE G 1328
ERGUN S 1276
1329

ESTOQUE M A 1533
ETHEREDGE L 1742
ETING S B 1427
EUSTIS F A 1395

FAERBER K P 1662
FEDER W A 1717
FELDSTEIN M 1402
1488
1518
FELDSTEIN M 1749
FELLENBERG T V 1658
FELMEISTER A 1711
FENG P 1424
FENN W O 1663
FENSTERSTOCK J C 1459
FIELD J H 1377
FILLER M E 1339
FILLEY G F 1709
FINCH A 1660
FIOCCO G 1425
FIORE G 1622
FISCHER R 1426
FISCHER W 1573
FLAJSMAN G 1600
FLUCK E 1583
FLYNN N E 1261
FOURNEY M E 1584
FOX F L 1716
1717
FOX H L 1585
FRANK E R 1633
FRANK N R 1664
FRANZEL H L 1330
FRASER T 1266
FREEDMAN R W 1448
FRYSINGER G R 1586

FUJITA N 1686
FUKABORI S 1490
FUKUDA H 1686
FUKUSAKI M 1332
FUKUZAWA H 1348
FULLERTON R W 1320
FUNKE G 1333
FUQUAY J J 1537

GARMANY J 1587
GASSER R P H 1588
GATZ D F 1531
GAULDING C L 1753
GAUR H C 1589
GEDGAUDAS M J 1267
GEORGII H W 1534
GERHARDS E 1590
GERHARDT P H 1743
GIBEAUT W A 1262
GIGUZ T L 1665
GIL DENSKIOL D R S 1427
GILBERT N 1476
GIRSEWALD C F V 1334
GISCLARD J B 1481
1482
GIULIANI V 1652
GLADKOVSKAYA A A 1705
GLUSHKOVA S D 1254
GODER R 1746
GOEBEL E 1370
GOETZ A 1428
GOL BERG M A 1429
GOLDEN J 1536
GOLDMAN A 1591
GOLDSCHMIDT K 1335
GOLDSMITH R L 1568
GOLDSMITH J R 1666
GOLOVOY A 1283
GOODWIN C 1376
GORDON D 1336
GORLIN S M 1535
GORLOVA O E 1675
GRANDJEAN J 1500
GREEN D 1773
GREENFIELD M A 1606
GREGORY K L 1667
GRENIER P 1337
GRIGOR EVA N V 1668
GRIMES W R 1630
GRISWOLD S S 1430
GROPPER S 1338
GROSS R W F 1580
GROSS S B 1275
1757
GRUBER C W 1431
1432

GUILLORY W 1592
GURINOV B P 1505
GUSEV M I 1675
GUYOT G 1400

HAGAN J E 1491
HAGEN D F 1268
HAGSTROM R 1697
HALEY H E 1315
HALITSKY J 1536
HALLALE N C 1751
HALPERN P 1536
HANSEN E G 1269
HANSON G P 1718
HANST P L 1433
HARADA S 1754

HARIHARAN T A 1434
HARMELIN M 1593
HARRIS R L JR 1774
HARSTAD J B 1339
HARTMANN F 1340
HASEGAWA J 1510
HASHIMOTO M 1775
HASHIMOTO K 1341
1342
1343

HASSEL O 1594
HATTORI D M 1473
HAUGEN D A 1537
HAUPT G 1297
HAUSER T R 1480
HAVER F P 1344
HECK W W 1716

HEDLEY W H 1595
HEICKLEN J 1644
HEJMA J 1345
HELD A J 1658
HELLSTROEM P A 1670
HENRY M C 1669
HENSCHLER D 1690
HENTZ R R 1596
HERSCH P 1435
HEUZE A 1570
HEXTER A C 1707
HIBBEN C R 1719
HIGH M D 1270
HILL G R 1556
HIMI K 1510
HIMI Y 1436
HINNERS R G 1437
HIPKIN A S 1346
HITCHCOCK M 1683
HOCHSTETTLER A D 1486
HODGES G H 1724

HODGSON F N 1286
HOEKE B 1347
HOFFER T E 1582
HOFFMANN A 1662
HOIDALE G B 1538
1597

HOLBUKE L E 1595
HOLIDAY G W 1268
HOLLANDER F H 1607
HOLLANDER B R 1607
HOLMA B 1670
HOLMQUIST E 1750
HOLTZCLAW K M 1739
HORNSBY SMITH M P 1293
HOROWITZ I 1704
HORST T W 1598
HORVATH H 1527
HOSKINS E L 1473
HOWELL E 1587
HUBNER R S 1606
HUGH JONES M E 1552
HULTZ J A 1487
HUNT J W 1271
HUTCHINSON P 1587
HWANG J Y 1438

IDDINGS F A 1439
IKI S 1510
IMAI M 1686
IMASHEVA N B 1671
INGARD U 1585
INGENITO F E 1672
1673

INOUE K 1385
IONESCU A 1648
IPSEN J 1672
1673

IRANI R R 1440

IRIYAMA F 1706
ISHIHARA Y 1348
ISHIKAWA F 1599
ISHINISHI N 1290
ISHIWATA H 1720
ISHIZUKA Y 1720
ITO K 1510

JACOBS R H JR 1349
JACOBSON J S 1441
JATIVA C D 1718
JELLINEK H H G 1600
JOHNSON D L 1776
JOHNSON L 1511
JOHNSTONE H F 1350
JONES R A 1639
JORDAN J 1497
JORDAN W V 1351
JOSEPH A 1376
JOST D 1534
JOTANI F 1272

KADOYA N 1720
KAELBLE E F 1440
KAGANOVA E L 1254
KAGANSKIY I M 1355
KAGAWA J 1706
KAHYO H 1706
KAMITSU K 1281
KANTOR S 1713
KAPALIN V 1674
KAS YAN N A 1539
KASAHARA K 1384
KATALIN Z 1508
KATIN A 1755
KATO S 1273
KATORI Y 1290

Author Index

KATS G 1442
KATZ M 1458
1601

KAWAI T 1443
KAWASHIMA T 1281
KAWASUMI M 1384
KAYNE N 1327
KELENFFY S 1444
KEMPNER S K 1352
KENSTAM A H 1595
KERN R 1602
KETTNER H 1445
KHACHATURYAN M K 1675
KHAN A A 1353
KIMURA H 1607

KITTLEMAN T A 1317
KIYOURA R 1354
KLUG W 1603
KNOP W 1274
KNOTT M J 1579
KNUNYANTS I L 1632
KOBAYASHI S 1385
KOBAYASHI Y 1510
KOCHERGIN N A 1355
KODAMA Y 1290
KOENUMA Y 1385
KOFOED HANSEN U 1604
KOLAR J 1446
KONISHI I 1605
KONONENKO L V 1572
KONONOVA V A 1676
KONOPATOV A P 1358
KOONTZ R L 1606
KOPA R D 1607
KOPCZYNSKI S L 1564
KORTH M W 1357
KORUNOVA A F 1572
KOYAMA O 1510

KOYASU H 1720
KRASOVITSKII Y V 1358
KRAUSS R K 1553
KRIVANDIN V A 1611
KRUEGER A P 1651
KUDO T 1510
KUMAGAI F 1706
KUMAI M 1540
KUNITAKE E 1290
KURIYAMA T 1384
KUZ MINYKH I N 1608

LACASSAGNE A 1677
LAHMANN E 1447
LAND R 1587
LANG H W 1448
LASIEWICZ K 1609
LATHAM L P 1709
LAUER U 1449
LE DUC M F 1327
LEBEAU R 1678
LEDUC E C 1764
LEGATE C E 1450
LENGYEL B A 1541
LEONE I A 1721
LEPPER M H 1700
LESTZ S S 1308
LEVADIE B 1488
1749

LEWIS H D 1591
LI P Z 1254
LIEBERMAN A 1451
LINVILLE W 1430
LODGE J P JR 1452
LODGE J P JR 1633
LONG W C 1360
LONNEMAN W 1564
LOVILL J E 1542

LOWE J R 1361
LOZANO E R 1422
LUCE C F 1756
LUCEY D G 1742
LUCIS O J 1681
LUCIS R 1681
LUDWIG J H 1362
1363

LUMENG J L 1700
LUNA R E 1543
LUNDGREN D A 1453
LUTZ G A 1275
1757

LYNAM D R 1454
LYNK M E 1681
LYON R H 1585

MACDOWALL F D H 1722
MAENO M 1720
MAHON KO K P 1594
MAISEL J C 1704
MAKEDONSKAYA R N 1415
MAKHON KO K P 1523
1545

MALANCHUK M 1579
MALINOSKI V F 1667
MAMMARELLA L 1455
MANNY E H 1295
MANOLACHE M 1736
MARKUS G A 1374
MARMO F F 1610
MARSAY C J 1588
MARTLAND L 1758
MASDIN E G 1367
MASTRYUKOV B S 1611
MASUDA S 1364
MATKIN J H 1584
MATOUSEK J 1732

MATSUDA S 1397
MATSUMOTO K 1385
MATSUOKA Y 1720
MAYER P 1618
MCCARTNEY J T 1276
MCENNERNEY S 1773
MCKEE H C 1277
1723

MCMULLEN T B 1459
MEADES M R 1293
MEGONNELL W H 1270
MEHTA D 1578
MENSER H A 1724
MEURER J S 1278
MEYER W E 1308
MIDDLETON J T 1725
1324

MIGUEL T H 1759
MIKHAILOVA Z V 1254
MILLER D W 1330
MILLER F A 1488
1749

MILLET J 1570
MILLINGTON B W 1279
MITOSERIU O 1736
MITSUI S 1599
MIYAWAKI A 1769
MIYAZAKI H 1510
MODELL M 1568
MOFFAT A J 1457
MOLINSKI S 1737
MONKMAN J L 1458
1481
1482

MONTEITH J L 1547
MONTGOMERY T L 1466
MOORE G E 1458
MOORE H 1402

MOORE P J 1275
1757

MOORE R H 1591
MORGAN G B 1459
MORI K 1366
MORI Y 1612
MORIK J 1508
MOSES H 1524
MOUNTAIN J T 1682
MUELLER H 1280
MUELLER P K 1683
MUKAMMAL E I 1726
MUNCACI E 1648
MUNRO A J E 1367
MURAKAMI M 1281
MURAKAMI M 1305
MUROOKA T 1599
MURRAY F E 1624
MYERS D S 1684
MYERS P S 1368

NADER J S 1460
NAGAI S 1566
NAGAO F 1461
NAKAMURA T 1706
NAKAMURA K 1706
1462

NAKANO M 1510
NANBU Y 1463
NARULA S P 1618
NAUCLER J O 1378
NAVRATIL J 1613
NELIGAN R E 1430
NELIGAN R E 1481
NELIGAN R E 1482
NEUKOMM S 1685
NEUMAN B 1614
NEUMANN B 1370

NEUWIRTH R 1726
NEWHALL H K 1615
NICKLIN T 1371
NICKOLA P W 1537
NIEMEYER L E 1282
NIESSEN W R 1315
NINOMIYA J S 1283
NISHIDA K 1372
NISHIKATA H 1385
NISHIKAWA Y 1720
NISHIWAKI K 1461
NOBE K 1637
NOBLE R W 1291
NOBLE W M 1727
NOELLER H G 1573
NOLL K E 1464
NORMAN V 1465
NUBER K 1284
NYVLT J 1613

O BRIEN H W 1540
O CONNOR J R 1744
O DONNELL H 1466
O DONNELL H J 1276
O NEILL W E 1448
OBLANAS J W 1417
OCHIAI S 1720
OGNEVA T A 1539
OHBA H 1605
OHNO T 1720
OKUMURA T 1605
OKUNO T 1397
OLT R G 1595
ONISHI G E 1325
ORATOVSKII V I 1374
ORMROD D P 1616
ORNING A A 1487
OSAWA S 1706

OSHIMA H 1686
OTAKA H 1461
OTTO H W 1728
OXHOLM M 1467
OYA T 1510
OZERSKII Y G 1374

PACK D H 1726
PADBERG K H 1617
PAMFIL G P 1571
PANZNER H 1370
PARKIN D W 1511
PASTERNAK R 1375
PAUL R C 1618
PEARSON K H 1398
PERASSO D 1376
PERRY H 1377
PERSMARK U 1467
PERSSON A R 1378
PETERSON D B 1596
PETRENCHUK O P 1513
PETSINGER R E 1285
PFEFFER R 1386
PHILLIPS D R 1511
PIERCE J O 1454
PIRCON L J 1379
PLESCHKA K 1468
POGINSKIY S Z 1619
POLLACK S V 1698
POPESCU O 1390
POPESCU V 1390
PORTEOUS A 1380
PORTER N S 1636
PORTHOUSE J D 1414
POSTNIKOV V F 1381
POTTER L B 1402
POTTINGER J F 1748
POWELL R S 1620
PRATT C D 1687
PRATT P 1704
PRAUSNITZ J M 1621
PRESCHER K E 1447
PRESTON G T 1621
PRETORIUS R 1469
PRIBYTKOV I A 1611
PRITCHARD W L 1432
PRODI F 1622
PRODI V 1622
PROPHET D T 1548
PUDLISZAK D A 1609
PUSTINGER J V JR 1286

QUON J E 1520

RAILEANU D 1736
RAMSEY J M 1688
RANDELL G E C 1293
RAO T N 1623
RAPOPORT I A 1689
RASCH R 1287
RAYMOND J C 1255
RAYNER H B 1624
RAYNOR G S 1470
RECORD R G H 1471
REED D J 1660
REGNER A 1569
REICHMANN R G 1288
REINKE W A 1625
RICH S 1729
RIES E D 1472
RIKHTER B V 1549
RIPPERTON L A 1481
RIPPERTON L A 1482
ROBBINS R C 1512
ROBERTS M H 1350
ROBINSON E 1512
ROECK G 1340
ROESNER G 1334
ROMAGNOLI R J 1541
ROMMING C 1594
ROSS R W 1763
ROSS W 1690
ROTARIU G J 1473
ROTHERAM M A 1474
ROUSSEAU H 1269
ROUSSEAU P E 1269
ROWDEN E 1289
RUFF I 1626
RUFOV Y N 1619
RUSSELL R R 1578
RYDER R 1704
RYSZKA E 1475

SABINO E G JR 1306
SACCO J F 1764
SAFRONOV V A 1691
SAIKI Y 1720
SAINT RUF G 1677
SAKAI W 1629
SALTZMAN B E 1476
1477
SANDULACHE L 1648
SANTAMOUR F S 1730
SARFATY M 1376
SARGENT F II 1770
SARUTA K 1510
SARUTA N 1510
1290
SASAMOTO H 1692
SAWATANI T 1479
SAWICKI E 1480
1481
1482

SCHAEFER H J 1534
SCHAFFER S G 1291
SCHIERMEIER F A 1282
SCHILLING F J 1708
SCHLEGEL H 1383
SCHMID H 1658
SCHMIDT N W 1627
SCHMIDT W 1567
SCHMITZ G 1662
SCHRECKLING K 1413
SCHROEDER W H 1640
SCHUMACHER H J 1628
SCHUMANN C E 1431
1432

SCHUSKY J 1771
SCHWENDIMAN L C 1483
1484
1485

SCOTT W E 1302
SEABORG G T 1292
SEEHMEL G A 1550
SEHMEL G A 1483
1484

SEHMEL G A 1485
SEILER E N 1352
SEIYAMA T 1629
SEKI S 1384
SELEZNEVA Y S 1513
SELLARS J H 1293
SENSHU T 1551
SETHI R S 1589
SHAFFER J H 1630
SHARP C R 1667
SHCHERBAK N P 1731
SHEESLEY D C 1633
SHIGEHARA R T 1294
SHIMAMOTO Y 1461
SHIMIZU Y 1385
SHIRAKA K 1693
SHUJI H 1772
SHUL TS E Z 1355
SIEGMUND C W 1295
SIEMIATYCKI J 1704
SIGSBY J E JR 1406
1296

SILVERBLATT H 1773
SIMPSON C L 1537
SIMPSON M H 1631
SJOSTRAND T 1694
SKLYAREVSKY L Y 1695
SKVORTSOVA N I 1659
SLADEK I 1514
SLEVA S F 1565
SMITH H O 1486
SMITH J F 1487
SMITH L P 1552
1470

SMITH R G 1488
1749

SMITH R M 1553
SMITH, J 1773
SMOLA J 1732
SNYDER M D 1636
SOKOL SKIY G A 1632
SON KIN L R 1515
SPAITE P W 1491
SPECTOR W 1742
SPEIZER F E 1696
SPENGLER G 1297
SPIERINGS F 1733
SPRAGUE H A 1697
SPURNY K R 1633
SQUIRES A M 1386
SRUTEK J 1732
SRYVALIN I T 1634
STANDLEY D 1336
STANFILL I C 1298
STANLEY T W 1480
STAPEL M 1768
STARKMAN E S 1299
STAUFF J 1628
STEPHENS E R 1739
STEPHENS B G 1489
STEPHENS E R 1488
1749

STERLING T D 1698
STERN K H 1635
STERRETT E 1300
STOCKELL F R JR 1682
STRESEMANN E 1699
STROM L D 1356
STUART B O 1636
STUMPH T L 1765
SUDDETH H A 1489
SUENAGA A 1629
SUHS R H 1700
SULLIVAN R A L 1511
SUTTERFIELD F D 1564
SUZUKI T 1510
1701

SVISTOV P F 1513
SWINBANK W C 1726

TADA O 1490
TAIT G W C 1554
TAKAGI S F 1702
TAKAHASHI K 1301
TAKEMOTO K 1703
TAKEMURA Y 1385
TAKENOUCHI H 1566
TAKEUCHI H 1510
TANAKA H 1397
TAYLOR F R 1302
TAYLOR G S 1729
TAYLOR J R 1501

Author Index

TAYLOR O C 1734
TAYLOR O E 1725
TEODORESCU M 1736
TERABE M 1510
1387

TEREKHOVA K M 1539
THOEN G N 1388
THOMAS F W 1555
THOMAS M D 1556

THOMPSON C R 1442
THORNE L 1718
THURLBECK W M 1704
TIMAN B L 1572
TIMARU J 1648
TKACHEV P G 1705
TODD W F 1491
TOMARAS Z G 1302
TOREGARD B 1467

TOYAMA T 1706
TRUBITSKAY G P 1254
TRUSOVA V N 1740

TSUJI M 1397
TURNER L G 1317
TWISS P C 1553

UCHIDA K 1344
UNDAGAWA O 1720
ULBRICH E A 1639
UMEDA H 1389
URLAUB A 1278
URONE P 1640
URY H K 1707
USINGER W 1468
UYEHARA O A 1368

VAISHNAVI B L 1641
VALKO P 1557
VAUGHAN H E 1303
VAUGHAN L M 1558
VEAZIE W H 1275
1757

VELDS C A 1517
VERMA M P 1708
VINSON R R 1465
VOICU V 1390
VVEDENSKAJA L I 1559

WADE B 1391
WAGGONER A P 1584
WAGNER N K 1560
WAGNER R H 1735
WAGNER W W JR 1709
WAID D E 1392
WAINERDI R E 1469
WAKAO N 1385
WALKER C A 1576
WALLIS G B 1380
WALSH J D 1561
WANDEL C F 1604
WANG C H 1660
WATANABE S 1495
WATANABE M 1642
WATANABE G 1305
WATKINS E R 1394
WATSON G W 1630
WATZDORF S V 1280
WAYNE W S 1710
WEATHERLEY M L P M 1503
WEBER G 1741
WEDGE U 1395
WEHRLE P F 1710
WEIAND H 1264
WEIGEL J E 1306

WEINER N D 1711
WEINKAM J 1698
WEISE E L 1635
WEISS, M
WELSH G B 1516
WESOLOWSKI J 1609
WHEELER R J 1277
WHITE N G 1488
1749

WICKEN A J 1712
WICKERT K 1643
WIEBE H A 1644
WILDER O H M 1379
WILLIAMS K R 1307
WILLIS C 1412
WILSON D 1564
WINCHESTER J W 1531
WINKELSTEIN W JR 1713
WINKLER G L 1308
WISSE J A 1517
WITTBOLD H A 1347
WOHLERS H C 1518
WOHLWILL M 1334
WONG M M 1344
WOOLLEY C J 1616
WRIGHT R H 1645
WU P 1536
WURSTNER A L 1595

YAGURA S 1706
YAGYU H 1519
YAMADA V M 1766
YAMAKI N 1396
YAMAMOTO T 1397
YAMAMOTO N 1706
YAMAWAKI K 1305
YANKOVSKIY I A 1496
YELESEYEV V S 1562

YEMELIN V P 1646
YODER R E 1664
YOKOYAMA T 1720
1692
YOKOYAMA E 1664
YOSHIDA K 1680
YOSHIDA T 1642
YOUNG P A 1398
YUDIN A M 1646
YUNGHANS R S 1422

ZAJDELA F 1677
ZAMBONIN P G 1497
ZAWADZKI E A 1399
ZAZO S 1652
ZDYBEL F 1587
ZHUZHIKOV V A 1358
ZOLOTAREV Y K 1646
ZRAZHEVSKIY I M 1535
ZWILLING J P 1400

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11373	11376	11613	11617	11629	11630	11631	11672	11676	11683	11691
11695	11697	11698	11707	11709	11762	11766	11793	11795	11805	11809
11814	11816	11818	11820	11822	11830	11844	11847	11848	11849	11854
11859	11859	11860	11862	11863	11866	11867	11868	11871	11926	11928
11931	11934	11936	11938	11939	11940	11941	11942	11943	11945	11953
11954	11955	11957	11963	11964	11997	11998	12000	12102	12102	12104
12109	12110	12111	12116	12117	12118	12120	12122	12125	12128	12131
12132	12133	12138	12139	12145	12146	12150	12151	12152	12153	12154
12179	12180	12184	12186	12190	12191	12192	12193	12194	12195	12198
12218	12219	12221	12224	12225	12229	12232	12233	12234	12238	12239
12241	12243	12244	12248	12253	12255	12256	12264	12265	12290	12291
12294	12296	12298	12300	12301	12304	12306	12307	12308	12309	12310
12311	12314	12319	12324	12325	12326	12329	12330	12331	12333	12334
12335	12337	12340	12345	12346	12351	12355	12357	12370	12371	12372
12375	12376	12377	12391	12395	12396	12399	12403	12406	12414	12415
12416	12417	12418	12420	12422	12423	12425	12430	12431	12432	12441
12442	12479	12480	12484	12489	12491	12492	12499	12508	12511	12513
12516	13607	15717	15974	16034	16271	16424	16577	16578	16579	16580
16581	16582	16583	16584	16585	16603	16729	16751	16755	16771	16774
16793	16805	16818	16837	17124	17191	17209	17212	17233	17244	17261
17277	17291	17293	17320	17322	17323	17360	17364	17366	17377	17378
17383	17408	17417	17418	17419	17420	17421	17422	17423	17424	17425
17426	17427	17428	17429	17431	17432	17433	17434	17435	17436	17437
17438	17439	17440	17441	17442	17443	17444	17445	17446	17447	17448
17449	17450	17451	17452	17453	17454	17455	17456	17457	17458	17459

Continued on next page

Preceding page blank

17460	17461	17462	17463	17464	17465	17466	17467	17468	17469	17470
17471	17472	17473	17474	17475	17476	17487	17488	17489	17490	17491
17492	17493	17494	17495	17496	17507	17508	17509	17510	17511	17512
17513	17514	17515	17516	17517	17518	17519	17520	17521	17522	17523
17524	17525	17526	17527	17528	17529	17530	17531	17532	17533	17534
17535	17536	17537	17538	17539	17540	17541	17542	17543	17544	17545
17546	17547	17548	17549	17550	17551	17552	17553	17554	17555	17556
17557	17558	17559	17560	17561	17562	17563	17564	17565	17567	17568
17569	17570	17571	17572	17573	17574	17575	17576	17577	17578	17579
17580	17581	17582	17583	17584	17585	17586	17711	17712	17713	17714
17715	17716	17717	17718	17736	17737	17738	17740	17741	17742	17743
17744	17745	17746	17747	17748	17749	17750	17751	17752	17753	17754
17755	17766	17767	17768	17769	17770	17771	17772	17773	17774	17775
17776	17777	17778	17779	17780	17781	17782	17783	17784	17785	17786
17787	17788	17789	17790	17791	17792	17793	17794	17795	17796	17797
17798	17799	17800	17801	17802	17803	17804	17805	17806	17847	17848
17849	17850	17851	17852	17853	17854	17855	17856	17857	18065	18066
18067	18068	18069	18070	18071	18072	18073	18074	18075	18076	18077
18078	18079	18080	18081	18082	18083	18084	18085	18086	18087	18088
18089	18090	18091	18092	18093	18094	18095	18096	18097	18098	18099
18100	18101	18102	18103	18104	18105	18106	18107	18108	18109	18110
18111	18112	18113	18114	18115	18116	18117	18119	18120	18121	18122
18123	18125	18126	18127	18130	18131	18132	18133	18134	18135	18136
18137										

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